Product type A was observed only in samples collected from location SE-120. The same pattern was observed in all samples collected from this location with positive TPH-Dx results. The petroleum pattern did not match that for diesel fuel or creosote and could not be identified. PAHs and PCP were not detected in samples collected from this location.

Product type B was observed only in samples collected from location SV-122 and SV-151. The same pattern was observed in all samples collected from location SV-122 with positive TPH-Dx results. The petroleum pattern did not match that for diesel fuel or creosote and could not be identified. PCP, low concentrations of PAHs (relative to the detected TPH), and low concentrations of diisopropyl ether were detected in samples from this location. Based on review of PAH/PCP chemical analysis results, this product type may be a carrier for PCP. PCP and PAHs were not analyzed for in the surface sample collected from location SV-151 where this product type was observed and this product type was not observed in any of the other samples collected at location SV-151.

Product types C and D were observed in numerous samples collected from the site. These two petroleum patterns are almost identical except for an unidentified peak (compound) present in product type D and not in product type C. The compound appears near C_{10}. Other than this difference, the patterns are very similar. Both product types contain numerous PAHs, including naphthalene, and closely resemble the pattern of the creosote standard that was analyzed with the FY99 soil samples. PCP was detected in approximately 20 percent of these samples. Diisopropyl ether was also detected in many of these samples; however, not necessarily in the same samples where PCP was detected.

Product type E was not observed in any of FY00 samples with chromatograms available for review.

Product type F was observed only in the top two samples collected from location SV-117. The samples contained very high concentrations of PCP and diisopropyl ether. The pattern of the chromatogram did not resemble a petroleum product. This product type is discussed further in Section 5.3.

5.2.2 Comparison of PAH/PCP Chemistry Across the Site

To determine what different petroleum product types are present at the site, an initial review of FASP laboratory TPH-Dx chromatograms was performed as described in Section 5.2.1. Product types A through D and F were identified in FY00 samples. To extend this evaluation, EPA Region 9 laboratory PAH/PCP chemical analysis results were reviewed along with the FASP laboratory TPH-Dx chemical analysis results (including chromatograms). Results for approximately 220 soil samples analyzed for TPH-Dx and/or PAH/PCP were reviewed. Data for PCP, naphthalene, TPH-Dx, total PAH, and total cPAH were sorted by location and reviewed to identify additional locations across the site where the petroleum product types identified during the TPH-Dx chromatogram review are present.

During the review, characteristics of the different product types (e.g., distinct chromatographic pattern, presence of PCP, presence of PAH) were identified. Characteristics of the different product types are summarized in Table 5-4.

Using these characteristics as a guide, product types were assigned to sampling results. Samples with TPH-Dx chromatograms available for review have a higher level of confidence than samples without TPH-Dx chromatograms because pattern recognition is a better tool for petroleum product identification than chemistry results alone.

Product type assignments and supporting chemistry results are summarized in Table 5-5 for samples included in this evaluation. Product types assigned from review of TPH-Dx chromatograms are shown in bold.

5.2.3 NAPL Chemical Description

No NAPL samples were collected during the FY00 investigation. During the FY99 investigation DNAPL was collected from ONS-1B, A-10, and DSW-6B and analyzed for petroleum hydrocarbons and SVOCs. Although LNAPL was measurable in some wells (i.e., A-8, ONS-1C, DSW-4B), the volume was insufficient for sampling. The product samples collected from A-10 and DSW-6B were emulsions that could not be separated in the field. The TPH-Dx analysis includes all organic compounds that fall into the C_{10} to C_{24} molecular weight range. The modified EPA Method 8015 used for the TPH-Dx analysis includes PAHs. The reported TPH concentration ranged from 916,000 ppm in ONS-1B to 131,000 ppm in DSW-6B. Presumably, the balance of these product samples would have been made up of shorter chain (less than C_{10}), lighter weight hydrocarbons and/or water. TPH chromatograms were not reviewed to identify specific product types.

SVOCs were detected in percent levels at each sampling location. Naphthalene was detected in concentrations that ranged from 130,000 ppm to 32,000 ppm in ONS-1B and DSW-6B, respectively. After naphthalene, the most abundant PAH is phenanthrene. Sample ONS-1B contained 33 percent PAHs.

Pentachlorophenol was detected in A-10 only (at 1,800 ppm). This finding is in agreement with the groundwater monitoring results, which indicate that PCP is found primarily in the A-zone.

All SVOCs included in the project target analyte list were detected in samples submitted for analysis. All NAPL samples contained a substantial portion of miscellaneous hydrocarbons that were not identified. These likely derive from the various fuel oils and other petroleum products used as carriers in the original PCP and creosote mixtures. NAPL sampling results are presented in Section 3.9.1. Results from the 1999 NAPL sampling effort are consistent with NAPL data collected in 1997 (ICF Kaiser 1998).

5.2.4 Diisopropyl Ether Chemistry and Environmental Fate and Transport

The fate and transport of chemicals used in the patented Cellon wood-preserving process are presented in this section. Chemical compounds used in the process are evaluated for increases in solubility and mobilization. This evaluation was done to determine if diisopropyl ether (DIPE) has a cosolvency effect on PCP and 2,3,7,8-dibenzo-p-dioxin (TCDD) at the site.

The Cellon process was used at the McCormick and Baxter facility in Stockton, California, to preserve wood products. Preservation components utilized in the process, including PCP and DIPE, have been identified at the site. The liquid solvent mixture used in the Cellon process is typically between 5 and 8 percent DIPE, 3 and 5 percent PCP, and between 87 and 92 percent liquefied petroleum gas (LPG). Liquefied petroleum gas is typically composed primarily of n-butane. The LPG and DIPE are essentially evaporated from the wood as part of the treating process and recovered.

DIPE has been detected at the site in soils and groundwater. In general, fate and transport aspects of the interaction of DIPE and PCP and additionally, TCDD, were evaluated to aid in interpreting concentrations encountered at the site and to evaluate the co-solvency effects of DIPE on PCP and TCDD.

5.2.4.1 Process Description

The U.S. Patent Number 3,200,003, *Process for Impregnating Wood with Pentachlorophenol and Composition Therefor,* was filed on January 11, 1962, and referred to as the Cellon process. By 1971, nine plants had been built and designed for the treatment of lumber using this process. More than 800,000 poles and many millions of board feet were processed (Davies 1971). The Cellon process was widely used in the 1970s but was phased out because the residence time of the preservative in the treated wood was found to be inadequate.

The principle of the Cellon process for impregnating wood is that the liquid solvent that carries the preservative into the wood is essentially evaporated from the wood and recycled, leaving only the preservative. This takes place as part of the treating process and while the wood is still in the treating cylinder. Thus, when the treated product is removed from the treating cylinder, it has essentially the same appearance as it had prior to treatment, is deeply penetrated with preservative and is capable of being painted or finished in the same manner as untreated wood (Davies 1971).

The Cellon process involves submersing wood in a treating solution at an elevated temperature (less than 200ºF) and a superatmospheric pressure of less than 200 psig (Davies 1971). The solution is comprised of the following:

- A hydrocarbon that is selected from the class of solvents that includes propane, n-butane, isobutane, n-pentane, isopentane, and mixtures of these solvents
- A preservative selected from the class of copper quinolinolate and pentachlorophenol
- A co-solvent that (1) has less than 10 percent water solubility; (2) has at least 25 percent solubility for the preservative; and (3) is soluble in the hydrocarbon to form a solution containing 2 to 6 percent (by weight) preservative and at least 2 percent (by weight) of the co-solvent (Bescher 1962)

The treating solution cannot contain more than 10 percent (by weight) of the co-solvent; and the co-solvent must also have the properties of preventing "blooming," defined as the appearance of PCP crystals on the surface of the wood within two days after treating (Nicholas 1973).

One process treating solution that was used commercially consisted of liquefied petroleum gas (LPG) composed primarily of n-butane, DIPE, and PCP, which are the solvent carrier, co-solvent, and preservative, respectively. The LPG and DIPE were essentially evaporated from the wood as part of the treating process and recovered. The dry, solid PCP remained in the wood (Nicholas 1973). Research work by the Koppers Company proved that the best co-solvent for pole treatment was DIPE. This co-solvent has a boiling point of 156°F as compared to the normal treating temperature of 170°F and very little DIPE remains in the wood after treatment (Arsenault 1970).

5.2.4.2 Evaluation of Co-Solvent Effect on the Solubility of PCP and TCDD

Worst-Case Scenario for PCP. Assume that the liquid solvent mixture in the process is discharged directly to soil and contacts groundwater. Further, assume that the resultant mixture of water and DIPE reaches the maximum solubility of DIPE in water of approximately 9,000 mg/L or 0.9 percent. What will be the effect of the co-solvent (DIPE) on the solubility of the solute PCP? Using equation 1, the general effect of the co-solvent (DIPE) on the solubility of PCP can be evaluated as follows:

$$\text{Ln } S^m = \ln S^w + \alpha f \qquad (1)$$

Where:

S^w = mole fraction solubility solute in water (dimensionless)
S^m = mole fraction solubility solute in mixed solvents (dimensionless)
α = alpha = parameter related to solutes' surface area and interfacial free energy
f = volume fraction of co-solvent ($0<f<1$).

Values for alpha are empirically derived.

S^w = solubility of PCP in water, approximately 17 mg/L
= 1.149×10^{-6} mole fraction

From above, assume DIPE is present at 0.9 percent by volume and assume $\alpha = 10$, f = 0.009 (generic alpha value from Lyman et al., 1992, used for alcohol and benzene; no DIPE/PCP alpha values were available).

$$\text{Ln } S^m = \ln(1.149 \times 10^{-6}) + 10\,(0.009) = -13.587$$

$$S^m = 1.257 \times 10^{-6} \text{ mole fraction}$$
$$= 18.6 \text{ mg/L}$$

As noted, in the worst-case scenario DIPE increases the solubility of PCP from 17 mg/L to 18.6 mg/L (approximately 9 percent).

Worst-Case Scenario for PCP at McCormick and Baxter Site. The maximum concentration of DIPE measured in groundwater at the McCormick and Baxter site was 0.027 mg/L compared to the worst-case assumption of 9,000 mg/L. Using the above analysis and a DIPE concentration of 0.027 mg/L, the expected increase in solubility of PCP was calculated. A DIPE concentration of 0.027 is expected to increase the solubility of PCP by less than 0.00003 percent.

Worst-Case Scenario for TCDD. Similarly to the above, assume that the liquid solvent mixture in the process is discharged directly to soil and contacts groundwater. Further, assume that the resultant mixture of water and DIPE reaches the maximum solubility of DIPE in water of 9,000 mg/L or 0.9 percent. What will be the effect of the co-solvent (DIPE) on the solubility of TCDD? Again, the general effect of the co-solvent (DIPE) on the solubility of TCDD can be evaluated similarly to PCP using equation 1 as follows:

S^w = solubility of TCDD in water, approximately 2×10^{-5} mg/L
= 1.118×10^{-12} mole fraction

From above, assume DIPE is present at 0.9 percent by volume and assume α = 10, f = 0.009 (generic alpha value from Lyman et al., 1992, used for alcohol and benzene; no DIPE/TCDD alpha values were available)

$$\begin{aligned} \text{Ln } S^m &= \ln(1.118 \times 10^{-12}) + 10\,(0.009) = -27.519 + 0.009 \\ &= -27.429 \\ S^m &= 1.223 \times 10^{-12} \text{ mole fraction} \\ &= 2.19 \times 10^{-5} \text{ mg/L} \end{aligned}$$

As noted, DIPE at a maximum concentration of 9,000 mg/L increases the solubility limit of TCDD from 2.0 X 10^{-5} mg/L to 2.19 X 10^{-5} mg/L (approximately 9 percent).

Worst-Case Scenario for TCDD at McCormick and Baxter Site. The maximum concentration of DIPE measured in groundwater at the McCormick and Baxter site was 0.027 mg/L compared to the worst-case assumption of 9,000 mg/L. Using the above analysis and a DIPE concentration of 0.027, the expected increase in solubility of TCDD was calculated. A DIPE concentration of 0.027 is expected to increase the maximum solubility of TCDD from 20 parts per trillion (ppt) to 20.000005 ppt (less than 0.00003 percent).

The maximum reported groundwater concentration of TCDD (27 ppb) is at or slightly above the solubility limit for TCDD in groundwater. Even when samples are filtered, TCDD adsorbed to colloidal particles could cause the observed exceedance of the TCDD solubility limit.

5.2.4.3 Summary

If one assumes that DIPE were found in groundwater at its maximum solubility of approximately 9,000 mg/L, one could expect approximately a 9 percent increase in the solubility of PCP and TCDD. At the maximum reported concentration of DIPE (0.027 mg/L) found at the McCormick and Baxter site in California, the expected increases in solubility of PCP and TCDD are less than 0.00003 percent.

Further, chromatographic separation of PCP, TCDD, and DIPE is expected to decrease effects described in the previous paragraph. Chromatographic separation will occur because these constituents have significantly different distribution coefficients and, therefore, are retarded differently relative to one another and relative to the groundwater velocity. The greater the distance along the flow path, the greater the expected separation of these constituents. The greater the separation of the constituents, the lesser the expected impacts from the co-solvent DIPE.

In summary, co-solvent effects at the McCormick and Baxter site are expected to be minimal and within the sampling and analytical uncertainty.

5.3 OCCURRENCE OF NAPL

Creosote NAPL has been visually observed in soil borings as a brown to black liquid with strong naphthalene odor. NAPL saturation observed in soil cores has ranged from oozing and/or dripping product to brown stains and/or sheen. Dripping/oozing product was most commonly observed in sandy materials but also occurred in silt to a limited extent. The presence of NAPL in the subsurface has also been interpreted from SCAPS LIF data. NAPL is present within both the sand and silt materials identified in the subsurface. However, NAPL was observed more often in sand materials than in silt, and sandy material tended to be uniformly saturated with product in soil cores. NAPL within the clayey silt material was usually observed as discontinuous blobs of NAPL or as thin, vertically oriented NAPL stringers. NAPL has also been observed in the unconsolidated slough sediments which are primarily clay and silt.

A separate, non-creosote diesel NAPL has been identified beneath the former PCP mixing shed which is located approximately 100 feet west of the site office building. The former PCP mixing shed area consisted of a large diesel storage tank, PCP mixing shed and the butt tank. This NAPL was visually confirmed at only one location, SE-122. A clear NAPL was present from 9 to 11 feet below ground surface (approx. 1.5 to –0.5 feet elevation NVD88) and had fuel odor rather than a creosote odor. NAPL was also identified from 31 to 35 feet below ground surface (approx. –20.5 to –24.5 feet elevation) at this location as brown and oozing with a fuel rather than a creosote odor.

A separate, non-creosote NAPL was also observed at one location (SV-117) in the Cellon Process Area. The NAPL was encountered at a depth of 8.5 to 10.5 feet (approx. 4 to 2 feet NVD88) and was brownish purple in color. This NAPL was primarily PCP and diisopropyl ether and probably was spilled when the Cellon process was used on site. Crystalized PCP and an ether odor was encountered in near surface soil throughout the Cellon Process Area. Soil sampling confirmed that it does not appear that there are any subsurface structures in this area. The Cellon Process Area may also be a source of creosote NAPL, which was observed beginning at approximately 25 feet below ground surface (approx. 12 feet NVD88).

The SCAPS LIF data, observations made in the field, and the soil data suggest four primary NAPL source areas: (1) former Oily Waste Ponds Area, (2) Cellon Process Area, (3) Main Processing Area, and (4) PCP Mixing Shed. The data also suggest that NAPL has and continues to migrate away from the first three of these source areas, extending downward as well as outward to the north, south, west, and east.

The SCAPS LIF data were input into GMS to develop a three-dimensional representation of the site's contaminant profile, which can be found in the SCAPS investigation report (USACE 2000a). Since the LIF sampling frequency decreases significantly below depths of 120 feet bgs (approx. 110 feet NVD88), the representation of the NAPL contaminant profile at depths greater than 120 feet bgs (approx. –110 feet NVD88) is incomplete.

The shaded region shown in Plates 3 through 12 represents the subsurface regions interpreted to contain NAPL. NAPL within the shaded region may occur as mobile NAPL, residual NAPL, pools of DNAPL on low-permeability silt, or thin, vertically discontinuous fingers/stringers. DNAPL may not be present everywhere within the shaded regions. The outer boundary of the shaded region represents the likely maximum extent of NAPL in the subsurface where the vertical and horizontal data density is adequate to define the extent of NAPL. The data density above approximately –100 feet elevation is high, and the maximum extent of NAPL above this elevation is well characterized. Below –100 feet elevation, data are relatively sparse. Therefore, NAPL pathways and the maximum horizontal and vertical extent of NAPL below –100 feet elevation are less certain.

The presence of NAPL is also illustrated in horizontal sections in Figures 5-1 through 5-40. Similarly to the NAPL presence shown on the above mentioned cross sections, the cross-hatched regions indicating NAPL presence on the horizontal sections (Figures 5-1 through 5-40), do not necessarily indicate that NAPL is everywhere present within the cross-hatched region for a given 5-foot-thick horizontal section. The interpreted maximum horizontal extent of NAPL in the subsurface is shown as a solid and dashed line in Figures 5-41 through 5-44. The dashed portion of the boundary indicates areas where NAPL is present but beyond which only limited data are available. Data are insufficient to determine whether NAPL extends beyond the property line at the dashed locations. Additional data could not be collected in these areas due to access limitations. The cross-hatched regions on Figures 5-1 through 5-40 are horizontal slices through a volume of space bounded by the top of NAPL and base of NAPL surfaces in Figures 5-41 and 5-43. Therefore, NAPL is known to exist somewhere, but not necessarily everywhere, within the cross-hatched region because NAPL is known to be present above and below this region.

Differences in the interpreted location of NAPL as presented in the interpolated SCAPS LIF data (USACE 2000a), the cross sections (Plates 3 through 12), and the simplified site geology horizontal sections (Figures 5-1 through 5-40) are due to the different methods used to generate and display NAPL presence and the purpose of these methods. The SCAPS report presents figures that show the interpolated LIF response of the SCAPS unit for the entire site. Other data (i.e., visual NAPL observations and soil analytical results) and knowledge of DNAPL fate and transport were not used to modify the interpolation of LIF data. Therefore, the SCAPS LIF interpolation plots represent a simple interpolation of the LIF data produced by the SCAPS rig without regard to connecting pathways of migration and the varying response of the LIF probe to NAPL in various geologic media (e.g., sand versus silt). Since the purpose of the SCAPS report was to document the results of the SCAPS tool, these interpolations are adequate to show the variation in LIF response across the site.

The extent of NAPL depicted in the cross sections (Plates 3 through 12) is based upon all data (e.g., LIF data, visual observations of NAPL, soil and groundwater analytical data) collected at the site and on interpretations of NAPL fate and transport in the site materials, which in turn are the basis of the conceptual site model of NAPL fate and transport. Therefore, the extent of NAPL shown in the cross sections is greater than in the LIF interpolations for two reasons: (1) more data (and data at greater depths) were used to interpret NAPL presence in the cross sections rather than in the LIF interpolations and (2) interpretations of NAPL continuity and NAPL transport between locations where LIF or other data indicated NAPL was present were made on the cross sections. Since the areas of NAPL shown on the cross sections between data collection points are interpreted, it is possible that the actual distribution of NAPL in the subsurface may be somewhat different than depicted.

The extent of NAPL depicted in the simplified geologic horizontal sections (Figures 5-1 through 5-40), like the cross sections, represents an interpretation of the maximum possible extent of NAPL based upon all available site data. However, the purpose of these figures is to represent the relationship between the maximum treatment volume for thermal remediation of NAPL and the relative continuity of permeable sand units and impermeable silts. For these figures, the fate and transport (i.e., the pathways of NAPL between measured NAPL data points) of NAPL were not considered. Instead, the total volume of space likely to contain NAPL is displayed since sufficient data to determine the exact location and migration pathways of NAPL are not available.

The shallowest zone of NAPL contamination was seen at less than 10 feet bgs (less than 0 feet NVD88), beneath the Main Processing Area and in the former Oily Waste Pond area near SE-086, SE-087, and SE-088. The deepest zone of NAPL contamination was found in SB-06 at 160 to 163 feet bgs (–146 to –149 feet NVD88) and SB-99 at 210 to 215 feet bgs (–195 to –200 feet NVD88). The most widespread contamination was found in the 20- to 65-foot-bgs (approx. –10 to –55 feet NVD88) interval across the site. LIF and soil data collected during the FY00 investigation indicates that the extent of NAPL in the eastern corner of the site (near the border of UPRR property) does not extend past push locations SE-126, SE-153, SE-124, SE/SB-154, SE-125, and SE-155. The extent of NAPL in areas outside the McCormick and Baxter property line southeast of the DSW-4 wells and south of SE-97 is still uncertain but is expected to be very limited.

The most significant NAPL contamination migrating from the source area northward under the slough appears to be limited to the area adjacent to the Main Processing Area. It is unclear if NAPL contamination in this area was the result of spills into the slough or NAPL transport in the subsurface from the Main Processing Area. Most likely NAPL contamination in this area is a result of transport through both pathways. LIF and soil data collected north of the slough confirms that NAPL is not present in this area.

Naphthalene concentrations are higher in the slough near SE-137 and in the main process area near SE-05 relative to other contaminant species elsewhere on site. Naphthalene crystals were found in soil samples collected at SE-137 between 4 and 6 feet below mudline. The LIF wavelength plot for push SE-137 is unique (i.e., two humps with unusually high wavelength of 486—510 nm) and is similar to other plots encountered in the main process area. Although there is no direct evidence that naphthalene concentrations are higher in the Main Process Area, the similarities in wavelength plots from SE-137 and SE-05 indicate that naphthalene is higher in these two areas.

Two unique near-surface (less than 30 feet bgs) source areas were identified near the entrance to the site at SE-43 and SE-47. The petroleum pattern in samples collected at these locations did not match that for diesel fuel or creosote and could not be identified.

5.3.1 Vadose Zone

NAPL, which was presumably released at or near the ground surface, has moved down through the clayey silt material that comprises the upper 20 to 30 feet of the subsurface. The water table was present within this uppermost clayey silt layer in April and July of 1999. The water table was lower during some pre-1999 measurement events and intersected the A1-zone sands. The clayey silt layer clearly does not act as an effective barrier to vertical NAPL migration. The dominant direction of NAPL migration within the vadose zone is downward based upon the lack of vadose zone NAPL at locations other than near the suspected source areas.

The majority of NAPL has migrated below the water table as DNAPL. However, NAPL appears to be present near the water table at SE-94. A large tank was located directly east of SE-94, and it is possible that a spill occurred near or from this tank. NAPL from a spill associated with this tank may not have penetrated deeply.

The shallowest occurrences of creosote NAPL in the vadose zone are beneath the former Oily Waste Ponds Area, the Cellon Process Area, and the asphalt cap that covers the former Main Processing Area (Figure 5-41). The largest net thicknesses of NAPL (Figure 5-44) are also in these three areas. Based upon the presence of vadose zone creosote NAPL and the net thickness of creosote NAPL beneath these areas, these three areas are the most likely source areas of creosote NAPL contamination in the subsurface.

The brownish purple PCP and diisopropyl ether NAPL encountered beneath the Cellon Process Area was encountered in one small area only. This NAPL may be limited in volume and limited to the vadose zone or it may have migrated deeper to mix with creosote DNAPL in the saturated zone beneath the Cellon Process Area.

The clear to brown NAPL with a fuel odor encountered beneath the PCP mixing shed also appears to be very limited in extent having been observed at only one location. It is likely that this NAPL was spilled on the surface in this area where PCP and diesel fuel were mixed together. This NAPL is suspected to be a LNAPL, and therefore it is likely that this LNAPL migrated downward to the water table. Since the water table elevation was lower in the past, the LNAPL observed below the water table was probably trapped by rising water levels and is now presumed to be immobile based on its location below the water table.

5.3.2 Saturated Zone

DNAPL has migrated from the water table to a maximum observed depth of 212 feet bgs (–197 feet NVD88). DNAPL is interpreted as having migrated in the saturated zone by moving vertically through permeable sand units, spreading laterally in sands on top of sloping low-permeability silts, pooling on low-permeability silts, and migrating vertically through silts.

The manner by which DNAPL is able to move through the relatively impermeable silts is not known. DNAPL was observed to be present in the silts as discontinuous blobs of NAPL and as thin vertically oriented stringers. Fractures were looked for, but were not confirmed in any soil cores in any borings.

DNAPL has migrated downward and to the south from the Oily Waste Ponds/Cellon Process Area to a maximum observed depth of 100 feet (approx. –90 feet NVD88) at the southern boundary of the site and to a depth of 130 feet in the vicinity of SE–61 (Plate 10 and Figures 5-18 and 5-19). The deepest observed occurrence of DNAPL is beneath the Main Processing Area (SB-099) at 212 feet bgs (–197 feet NVD88). The Main Processing Area is also a suspected NAPL source area, and vertical migration in this area has been dramatic. DNAPL is interpreted to have moved vertically through multiple low-permeability silt layers (Plates 5, 6 and 11). DNAPL has also migrated laterally and downward from the Main Processing Area toward the southeast (SE-93) and the UPRR property line (as approximated from parcel maps) and toward the south beneath the office building to the southern boundary of the McCormick and Baxter property near the main gate (Plate 11).

NAPL is present at some depth within nearly all of the recent unconsolidated sediments in the portion of the slough east of the Cellon Process Area. The southern half of the slough sediments in the vicinity of the Oily Waste Ponds are contaminated with NAPL, while the northern half of the slough sediments in the vicinity of the Oily Waste Ponds and sediments west of the Oily Waste Ponds appear to be free of NAPL (Figure 5-41). NAPL is also present beneath the recent unconsolidated slough deposits (slough sediments) in the silts and sands that are characteristic of the materials beneath the upland portion of the site (upland sediments). The deepest observed NAPL (push SE-137) beneath the slough sediments extends to an elevation of –70 feet (Plate 4 and Figure 5-15). Because NAPL was still present near the total depth of the SCAPS push used to define the deepest NAPL beneath the slough, deeper undetected NAPL below the base of this push may exist. Deep (i.e., below the slough sediments) NAPL is not present on the north side of the slough. Two rotosonic borings drilled to 250 feet below ground surface (approx. –240 feet NV88) on the north side of the slough confirm that deep NAPL has not migrated north of the slough.

The pattern of interpreted NAPL distribution beneath the slough (Plates 4, 9, 10, 11 and 12) is consistent with NAPL spilled in the slough as a source for deeper contamination beneath the slough. Deep NAPL beneath the slough occurs in areas where there is a low point or depression in the unconsolidated slough sediment/consolidated recent flood basin sediment interface. DNAPL may have migrated to these depressions, pooled and subsequently drained into the deeper sediments beneath the bottom of the slough. Alternatively, deep NAPL beneath the slough may have migrated from upland sources (i.e., Main Processing Area).

DNAPL may have migrated beyond any or all of the dashed portions of the NAPL boundary shown in Figure 5-41. DNAPL may have migrated past the southern property boundary at the main gate and the southeast corner of the stormwater retention ponds at elevations ranging from –50 to –100 feet and –80 to –90 feet, respectively.

DNAPL sampled from on-site wells has a density only slightly greater than that of water, with measured densities ranging from 0.96 to 1.05 mg/L. Flowing groundwater may be able to exert a horizontal force sufficient to alter the otherwise downward vertical vector of DNAPL migration. Groundwater flow is generally to the southeast and east; DNAPL migration, in addition to moving downward, has generally moved east and southeast away from the source areas, with little or no apparent migration of DNAPL to the north or west. Since site DNAPL has been observed to move through silt as well as sand, it is possible that the southeastward and eastward component of DNAPL migration may be influenced by the local groundwater gradient rather than, or in addition to, stratigraphic and density factors.

5.3.3 Volume Estimates

NAPL occurrence data, compiled from this investigation and previous subsurface exploration efforts, was used to map product distribution and estimate site-wide NAPL volumes. The elevations at which NAPL was observed or interpreted to occur in a boring or SCAPS push are listed in Table 5-6. The shallowest depth NAPL was encountered at each location is given in the “top NAPL” column in Table 5-6. These depths were chosen on the basis of significant staining or sheen, free-product visual observation, chemical analyses, and/or LIF response. Locations where shallow data were lacking such as sonic borings were not used. The deepest point at each location where NAPL was encountered is shown in the “base max NAPL” column. If a particular sampling location did not reach a depth comparable to nearby locations with observed NAPL at that depth or greater, this location was not used for analysis. The total number of feet at each subsurface location interpreted to contain NAPL is shown in the “net NAPL” column. The net thickness of NAPL is not necessarily equal to the distance between the top of NAPL and the bottom of NAPL at any individual location because intervals of non-NAPL contaminated soil were often encountered between the top and bottom of observed NAPL. All NAPL surfaces are truncated along the southern property boundary where areas of NAPL contamination intersect site boundaries because off-site data are limited to widely spaced monitoring wells.

The data in Table 5-6 were used to create the surface plots shown in Figures 5-41 through 5-44. The top of NAPL contours (Figure 5-41) represent the highest elevations where NAPL was observed in the subsurface. The surface contours in Figure 5-42 represent the deepest elevations of NAPL encountered in the subsurface. The volume of space between the two surfaces is approximately 27,000,000 ft^3 (1,000,000 yd^3). Therefore, the total volume of space that exists between the shallowest and deepest known occurrences of NAPL within the maximum areal extent of known NAPL is 27,000,000 ft^3.

A third surface (Figure 5-43) was created to represent the base of NAPL at an elevation of –100 feet and above. Data suggest that the bulk of the NAPL is present above –100 feet elevation. NAPL below this elevation is apparently present in small quantities and occurs in thin, hard-to-locate stringers. The volume of space between the surfaces shown in Figures 5-41 and 5-43 is approximately 24,000,000 ft^3 (900,000 yd^3). Therefore, the total volume of space that exists within the maximum areal extent of known NAPL and between the shallowest known occurrences of NAPL and an elevation of –100 feet is 24,000,000 ft^3.

The thickness of NAPL-contaminated soil at each boring/push was determined by adding together the intervals of observed and interpreted NAPL at each sampled location to derive a net total thickness at each location. The net thickness, therefore, is not necessarily equal to the distance between the top and bottom of observed NAPL an any particular location. Figure 5-44 is an interpreted contouring of the net soil containing NAPL. The net thickness of NAPL is useful in order to estimate the volume of liquid NAPL present in the subsurface because only portions of the subsurface that contain NAPL are used in the calculation. The volume of soil contaminated with NAPL represented by the net thickness map is approximately 7,300,000 ft^3 (270,000 yd^3). Assuming a porosity of 0.35 and values of NAPL saturation in the pore space of 4 percent (the median of site specific laboratory NAPL saturation data), yields a volume estimate of NAPL in the subsurface of 760,000 gallons. This estimate is highly uncertain due to the large measured range of NAPL saturation. Also, this estimate is likely biased low due to the possibility that some NAPL (especially NAPL at great depths) was missed during site investigation activities.

5.4 DESCRIPTION OF GROUNDWATER CONTAMINATION

Naphthalene, PAHs, dioxins, PCP, and arsenic were identified as indicator chemicals of the extent of dissolved-phase groundwater contamination in the RI report (ICF Kaiser 1998). Diisopropyl ether was added to the list of indicator chemicals of the extent of groundwater contamination based on past industry reports of diisopropyl ether use as a cosolvent with PCP in the Cellon Process. PCP and diisopropyl ether were targeted for analysis during the April 2000 sampling event. VOCs (i.e., diisopropyl ether) had not been analyzed during any previous groundwater sampling events.

5.4.1 Preliminary PCP and VOC Groundwater Sampling

Four A-zone monitoring wells (A-3, A-4, A-5, and A-6) where relatively high concentrations of PCP with low or non-detect levels of naphthalene were previously measured, were sampled and analyzed for diisopropyl ether (method 8260) and PCP (method 8270) during the Spring of 2000. The PCP results of this preliminary PCP and VOC groundwater sampling are shown in Figures 5-45 through 5-48.

The April 2000 PCP concentration was lower in the sample from well A-3 than concentrations measured during previous sampling events. PCP had ranged from approximately 20 to 100 µg/L for 10 samples (with one non-detect at 10 µg/L) from January 1984 to January 1996 (Figure 5-45). The PCP concentration for well A-4 measured in April 2000 was similar to previous levels measured since January 1996. PCP concentrations in well A-4 have generally declined from a high of approximately 1,100 µg/L in January 1984 to values around 100 µg/L in 1996 and 1997 (Figure 5-46). PCP concentrations at well A-5 had been relatively constant from 1984 to 1993 at approximately 2,000 to 3,000 µg/L then began a steady decline to 10 µg/L in 2000 (Figure 5-47). PCP concentrations at well A-6 have varied between approximately 200 and 2,000 µg/L since January 1984, but have been over 1,000 µg/L since 1995. The April 2000 PCP concentration measurement was consistent with recent concentrations measured at A-6 (Figure 5-48). Measured diisopropyl ether (26 µg/L at A-4 and 14.8 µg/L at A-6) corresponded to the two wells sampled that had relatively high PCP concentrations.

5.4.2 Summary of Extent of Groundwater Contamination

The extent of dissolved-phase contamination was investigated and discussed in the RI report (ICF Kaiser 1998) and the FY99 NAPL Investigation Field Investigation Report (USACE 1999c). Conclusions from the RI were reinterpreted to account for all FY99 and FY00 information regarding the presence of NAPL in the subsurface and new groundwater concentration data. Plates that illustrate contaminant trends at each project monitoring well were included in the FY99 NAPL Investigation Field Investigation Report.

5.4.2.1 Naphthalene

Naphthalene is present dissolved in groundwater in aquifer zones A through E. In A-zone wells, significant concentrations of naphthalene have only been detected in wells known to contain NAPL (A-8, ONS-2A, and A-10) or in areas where NAPL is interpreted to be present or nearby. Naphthalene concentrations at wells located within the subsurface volume interpreted to contain NAPL, or near NAPL-contaminated wells, are within or above the effective solubility concentrations calculated for naphthalene in the RI (6,000 to 15,000 µg/L). One exception to this trend is well A-1, which is upgradient of all known source areas and had high (90 to 170 µg/L) concentrations in the late 1980s, but has otherwise had concentrations that were nondetected or less than 10 µg/L. It is possible that dredging of the slough in 1987 opened a temporary hydraulic connection between the contaminated slough sediments and the A-zone sands, allowing a slug of naphthalene-contaminated water to flow through well A-1.

A-zone wells located outside, but immediately downgradient, of the A-zone area containing NAPL have low to nondetected levels of dissolved-phase naphthalene. This suggests that naphthalene has not traveled far ahead of the NAPL plume in the A-zone at significant levels or that A-zone wells downgradient of NAPL are not hydraulically connected to NAPL-contaminated soils and groundwater. Assuming that groundwater velocity in the A-zone sands is 0.2 ft/day and that 45 years have elapsed since contamination entered the groundwater, yields a maximum travel distance of 3,300 feet for groundwater during this time. However, down-gradient wells that are within 600 feet of known source areas (e.g., A-4, A-5, A-6 and A-7) have measured naphthalene concentrations that are low (less than 30 µg/L or not detected). Dispersion alone is unlikely to account for the low concentrations observed ahead of the NAPL plume. Therefore, some other mechanism (e.g., biodegradation, sorption) may be retarding the naphthalene and account for the lack of significant dissolved-phase contamination ahead of the NAPL plume in the A-zone.

Four B-zone wells (ONS-1B, DSW-4B, DSW-5B, and DSW-6B) have naphthalene concentrations near, within, or above the range of effective solubility for naphthalene calculated in the RI. All four of these wells are screened within the area interpreted to have NAPL in the B-zone and/or NAPL has been detected in the well. As with the A-zone, B-zone dissolved-phase naphthalene concentrations downgradient of interpreted B-zone NAPL contamination are nondetected or are low (less than 10 µg/L). Naphthalene concentrations in well ONS-2B are also low to nondetected suggesting that dissolved-phase naphthalene has not migrated vertically ahead of the DNAPL and/or that the B-zone is not hydraulically connected to the A-zone in the vicinity of the ONS-2 wells.

Three C-zone wells (ONS-1C, DSW-1C, and DSW-4C) have naphthalene concentrations near, within, or above the RI calculated effective solubility range. Wells ONS-1C and DSW-4C are screened within the interpreted NAPL contaminated area of the C-zone. Well DSW-1C is not located within the area interpreted to be contaminated with NAPL. It is possible that NAPL may be present at or near this well. SCAPS LIF data are not available for this depth, but a deep sonic boring penetrated to the E-zone at this location and no NAPL was observed at any depth. C-zone NAPL contamination is present beneath the asphalt cap, and NAPL could have migrated from beneath the asphalt cap to well DSW-1C and would not have been detected by SCAPS LIF and could have been missed by nearby sonic boring SB-126. Alternatively, dissolved phase naphthalene may be able to travel several hundred feet ahead of the DNAPL contamination without significant retardation. As with the A- and B-zones, most wells down-gradient of known C-zone NAPL contamination generally have low or nondetected naphthalene concentrations. Two exceptions are wells DSW-6C and ONS-2C. In well DSW-6C, naphthalene concentrations are now 800 µg/L and have been generally increasing with time. NAPL contamination from the B-zone may be migrating downward to the C-zone or dissolved phase naphthalene may have traveled vertically. Naphthalene concentrations in well ONS-2C have been moderate (17 to 26 µg/L). No NAPL has been interpreted to be present in the C-zone near this well. However, LIF response was noted at SCAPS locations SE22 and SE60 at depths that fall between the B- and C-zones. The LIF response was at or below the 100 count limit at both locations at the suspect depths, so NAPL was interpreted to not be present. It is possible that a thin stringer of NAPL may have moved down to between the B- and C-zones (80 to 90 feet bgs) in this area.

Two D-zone wells (DSW-1D and OFS-4D) have naphthalene concentrations near, within, or above the RI calculated effective solubility. DSW-1D is outside the current interpreted NAPL-contaminated area, but NAPL could be present at or near this well or dissolved phase naphthalene may not be significantly retarded in groundwater over distances of several hundred feet in this zone for the same reasons given for DSW-1C above. Well OFS-4D is located off site approximately 500 feet southeast of the DSW-4 wells. NAPL was not observed during the drilling of soil boring SB-165, which is roughly half way between the DSW-4 wells and OFS-4D. Naphthalene concentrations in well ONS-1D have risen steadily with time, suggesting that NAPL contamination from the C-zone may be migrating downward to the D-zone at this location. Naphthalene concentrations in well ONS-2D were inconsistent between the two measurement events. The presence of dissolved-phase naphthalene in well ONS-2D is consistent with naphthalene detected in ONS-2C, suggesting a strong hydraulic connection between the two wells and/or deep NAPL or dissolved phase naphthalene migration. Few D-zone wells are present downgradient of suspected NAPL zones so it is not possible to describe the potential extent of dissolved-phase contamination beyond the suspected NAPL boundaries.

Except for well OFS-4E, all E-zone naphthalene concentrations were nondetected or very low. Naphthalene concentrations in well OFS-4E have declined steadily with time, from 3,600 to 600 µg/L. Initial naphthalene concentrations in this well were near the solubility limit of naphthalene indicating that either NAPL has migrated near this well or naphthalene is not significantly retarded over distances of several hundred feet in this aquifer zone.

5.4.2.2 PCP

PCP is generally present in groundwater when naphthalene is present at concentrations high enough to be indicative of NAPL presence. PCP concentrations are generally lower than naphthalene, presumably due to the lower calculated solubility of PCP (2,000 to 5,000 µg/L) and also possibly due to lower mobility of PCP relative to naphthalene in groundwater. The concentration and extent of dissolved-phase PCP generally decrease with depth in the aquifer until PCP is essentially nondetected within the D- and E-zones.

The distribution of PCP in the A-zone, however, deviates substantially from that of naphthalene. PCP is present in wells at concentrations near, within, or above its calculated effective solubility within the interpreted area of NAPL contamination and known NAPL-contaminated wells (A-10, ONS-2A, and A-8). However, PCP has also been detected near, within, or above its calculated effective solubility levels in A-zone wells (A-4, A-5, and A-6) down-gradient of the interpreted NAPL-contaminated soil volume. PCP concentrations (approximately 20 to 120 µg/L) in well A-3 have also been higher than naphthalene concentrations (generally non-detect) measured in this well.

The mechanisms controlling the relative mobility of dissolved phase PCP in the various aquifer zones are presently unknown. Since no NAPL was identified in the shallow A-zone aquifer during FY00 soil sampling, a non-creosote, PCP carrying NAPL is not responsible for the PCP contamination present along the southern boundary of the site in the A-zone. Cosolvency effects of diisopropylether from the Cellon Process have been demonstrated to cause negligible additional mobility of PCP. The possibility that relative PCP mobility in groundwater is controlled at the site by biodegradation mechanisms is being investigated as part of the remedial design groundwater monitoring.

Sixteen microwells were screened within the A1-zone sand unit along the down-gradient margin of the site and within the interior of the site. Results from the analysis of natural attenuation parameters should further the understanding of PCP relative mobility and yield information regarding the extent and sources of PCP contamination in the A1-zone sand unit of the aquifer.

5.4.2.3 Dioxins and Furans

Dioxin is present in dissolved-phase groundwater and shares some of the distribution patterns mentioned in Sections 5.4.2.1 and 5.4.2.2 for naphthalene and PCP. Dioxin data are sparse and are limited to pre-2000 investigations, but some general trends are evident. Dioxin is present in all aquifer zones and in wells where naphthalene concentrations or other data indicate that NAPL is present or nearby. Dioxin, like PCP, is also present in A-zone wells (A-3, A-5, and A-6) outside and downgradient of the interpreted NAPL-contaminated area. A-zone dioxin is likely transported as an impurity of the PCP contamination by the same mechanism that is allowing relatively high mobility of the PCP relative to other aquifer zones.

5.4.3 Natural Attenuation Parameters

A series of water quality and natural attenuation parameters were measured for the monitoring wells sampled during the FY99 NAPL investigation. The parameters were collected to begin assembling data for a study of natural attenuation at the site. Additional data are needed before conclusions regarding natural attenuation can be made. A remedial design groundwater monitoring program began in November of 2000. This program includes quarterly monitoring for natural attenuation parameters (i.e., redox potential, pH, temperature, dissolved oxygen, carbon dioxide, iron, total organic carbon, SVOCs, PCP, sulfate, chloride, nitrate, nitrite, manganese, and methane). The conceptual model will be updated as groundwater monitoring results become available.

LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
2. Contouring accomplished using the minimum curvature method in Surfer v. 7.
3. Cross-hatched regions are horizontal slices through a volume of space bounded by the top of NAPL and base of NAPL surfaces. NAPL is known to exist somewhere, but not necessarily everywhere, within the cross-hatched region, because NAPL is known to be present above and below this region.
4. Data from 0 to -100 feet are limited to quantitative SCAPS results. Due to limited data below -100 feet, all available boring logs, SCAPS data, and geophysical logs were used. The limits of the bounding area reflect variations in quantity and quality of data.

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FY00 NAPL Investigation

Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
0 to -5 Feet Elevation

STOCKTON	**Figure 5-1**	CALIFORNIA

LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
2. Contouring accomplished using the minimum curvature method in Surfer v. 7.
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4. Data from 0 to -100 feet are limited to quantitative SCAPS results. Due to limited data below -100 feet, all available boring logs, SCAPS data, and geophysical logs were used. The limits of the bounding area reflect variations in quantity and quality of data.

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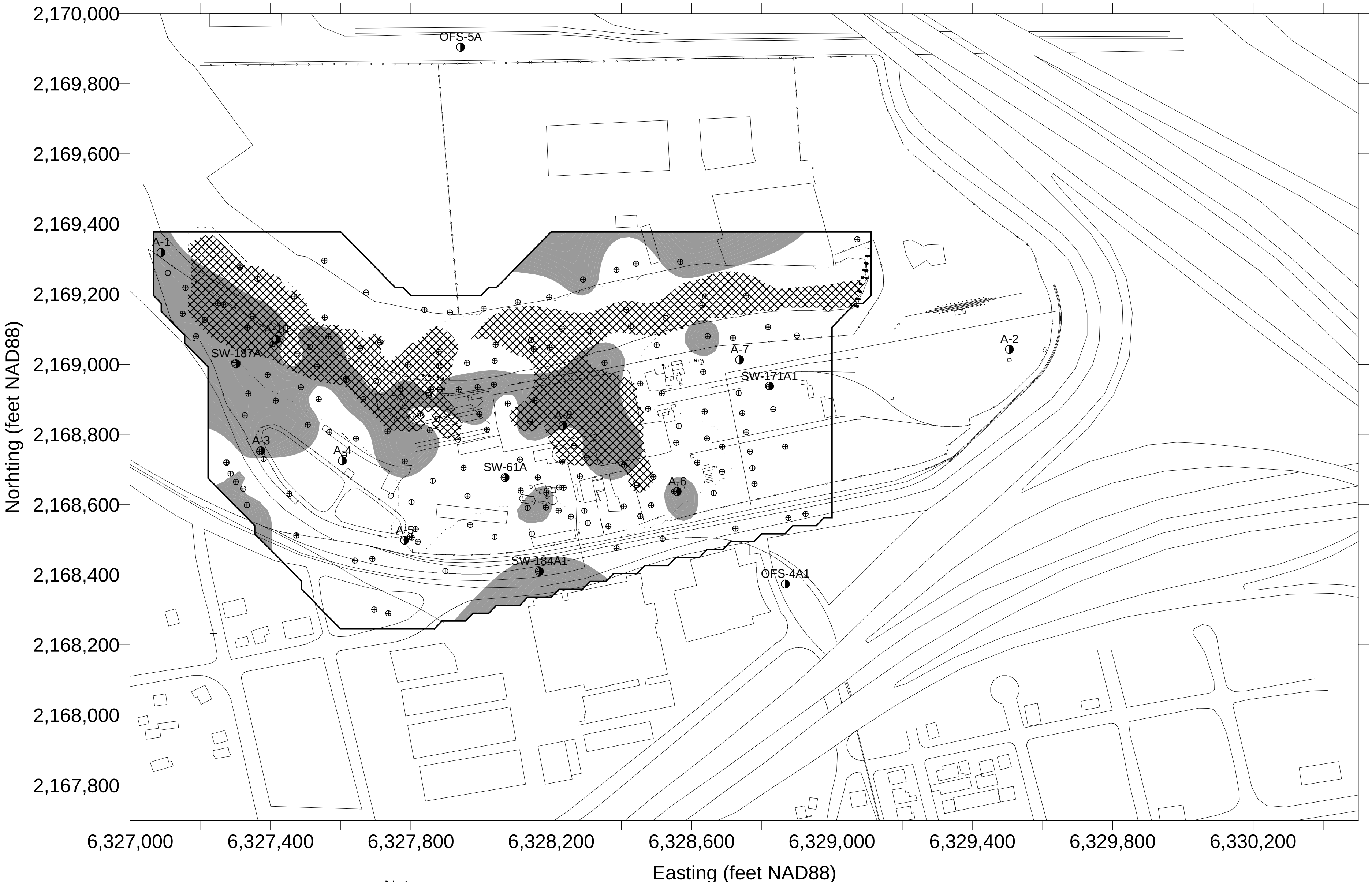
FY00 NAPL Investigation

Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-5 to -10 Feet Elevation

STOCKTON	**Figure 5-2**	CALIFORNIA



LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

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2. Contouring accomplished using the minimum curvature method in Surfer v. 7.
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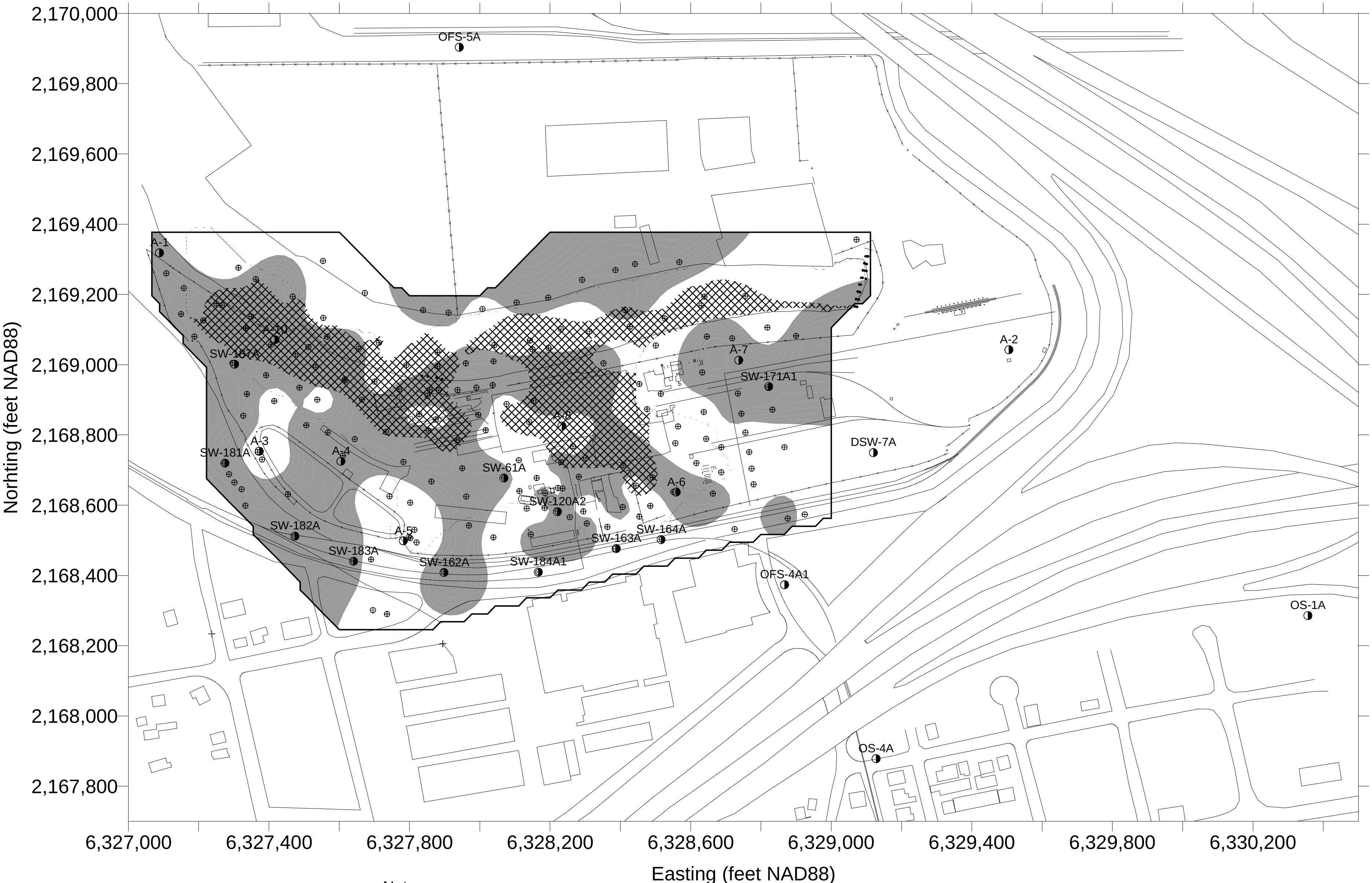
Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-10 to -15 Feet Elevation

STOCKTON	**Figure 5-3**	CALIFORNIA



LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:
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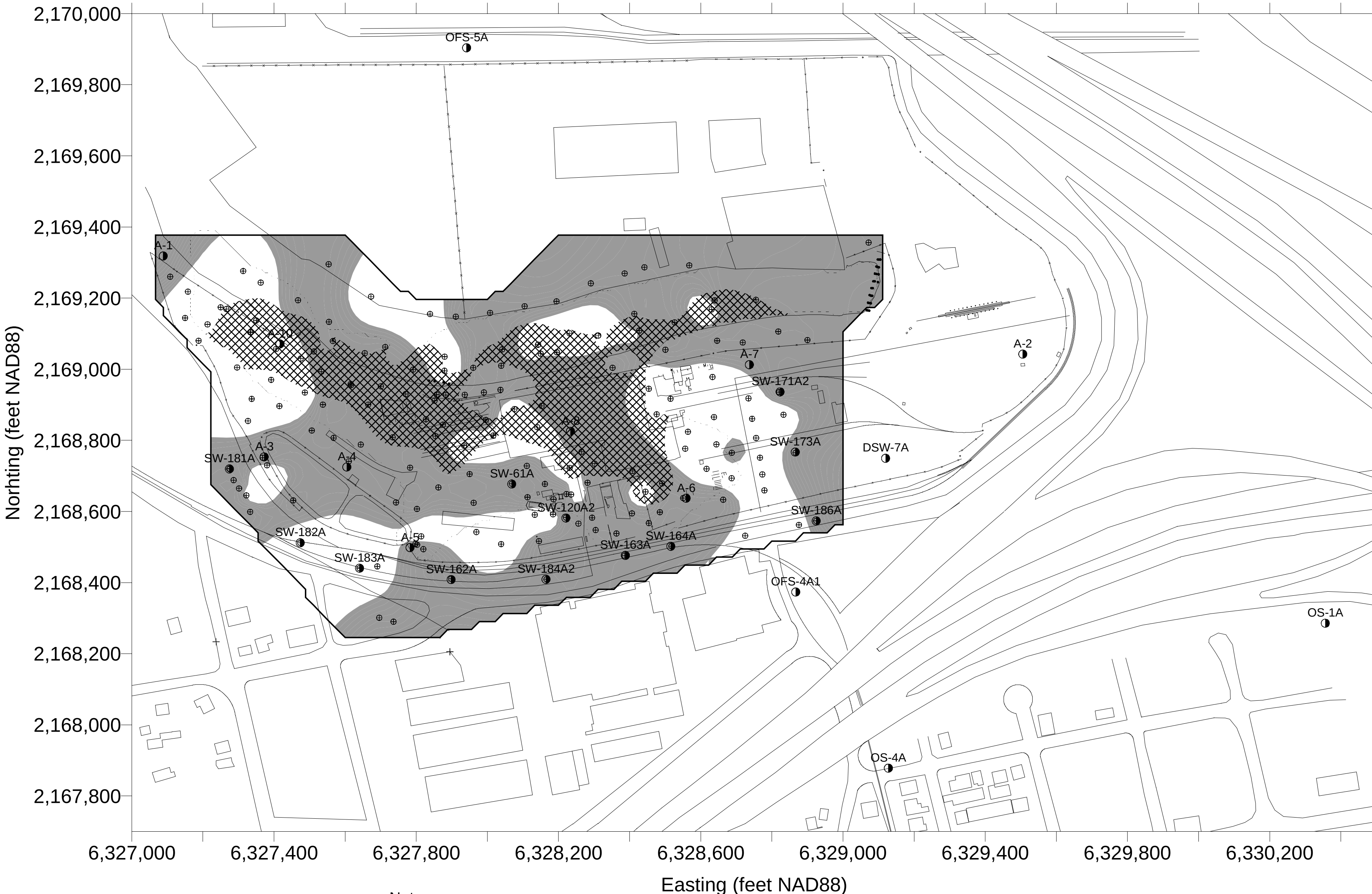
FY00 NAPL Investigation

Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-15 to -20 Feet Elevation

STOCKTON	**Figure 5-4**	CALIFORNIA



LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

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4. Data from 0 to -100 feet are limited to quantitative SCAPS results. Due to limited data below -100 feet, all available boring logs, SCAPS data, and geophysical logs were used. The limits of the bounding area reflect variations in quantity and quality of data.

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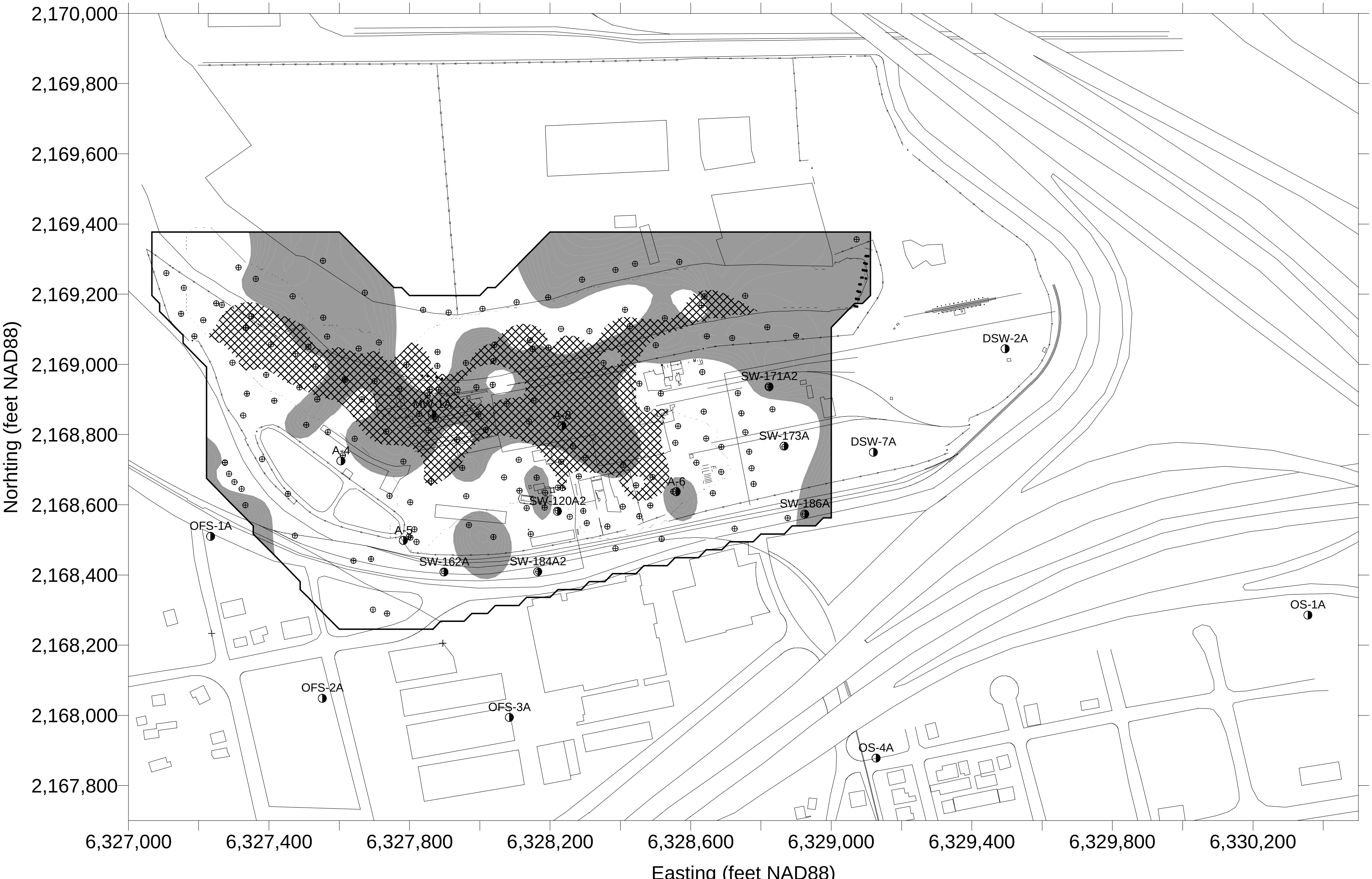
FY00 NAPL Investigation

Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-20 to -25 Feet Elevation

STOCKTON	**Figure 5-5**	CALIFORNIA



LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

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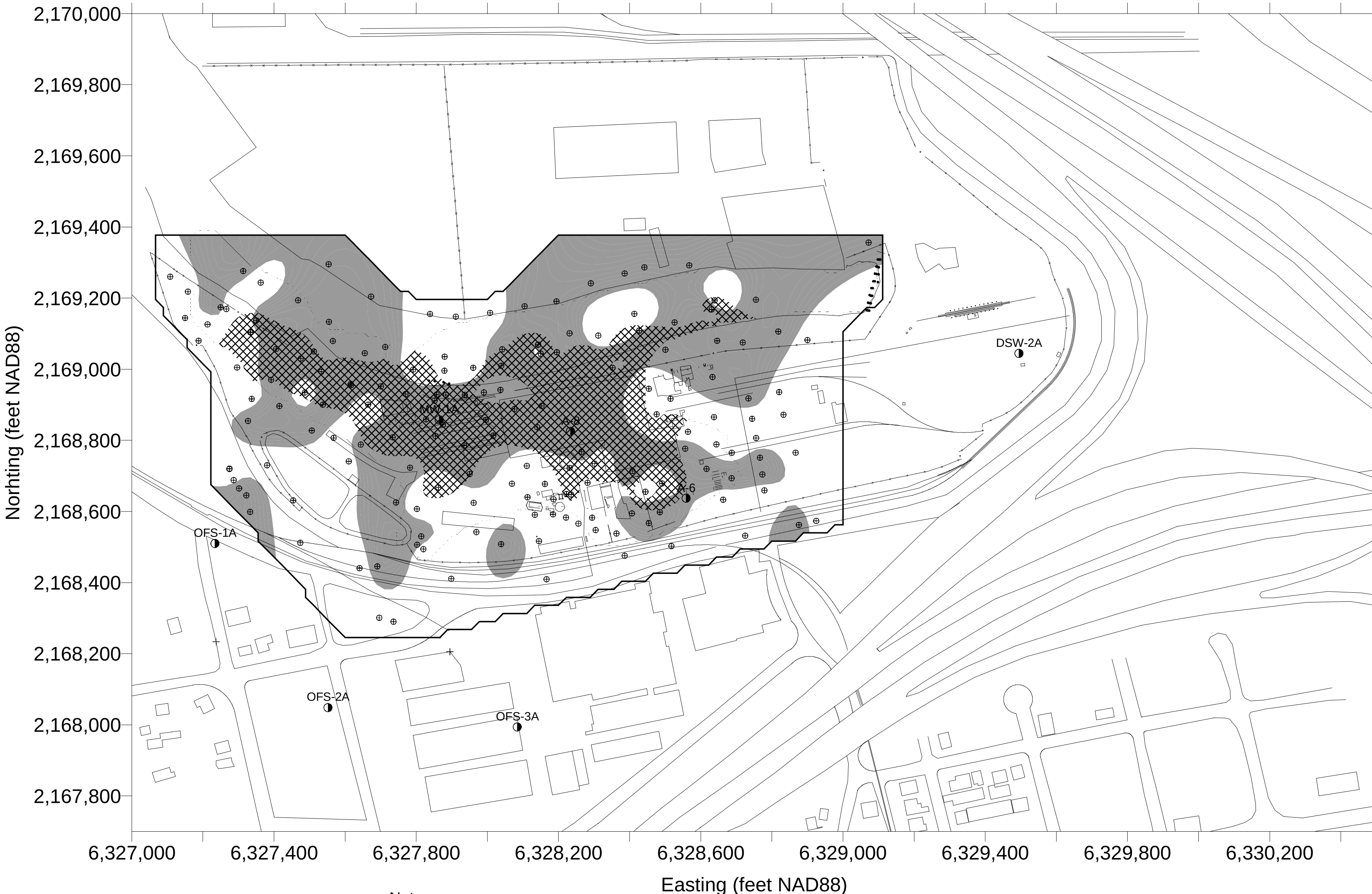
FY00 NAPL Investigation

Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-25 to -30 Feet Elevation

STOCKTON	**Figure 5-6**	CALIFORNIA



LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

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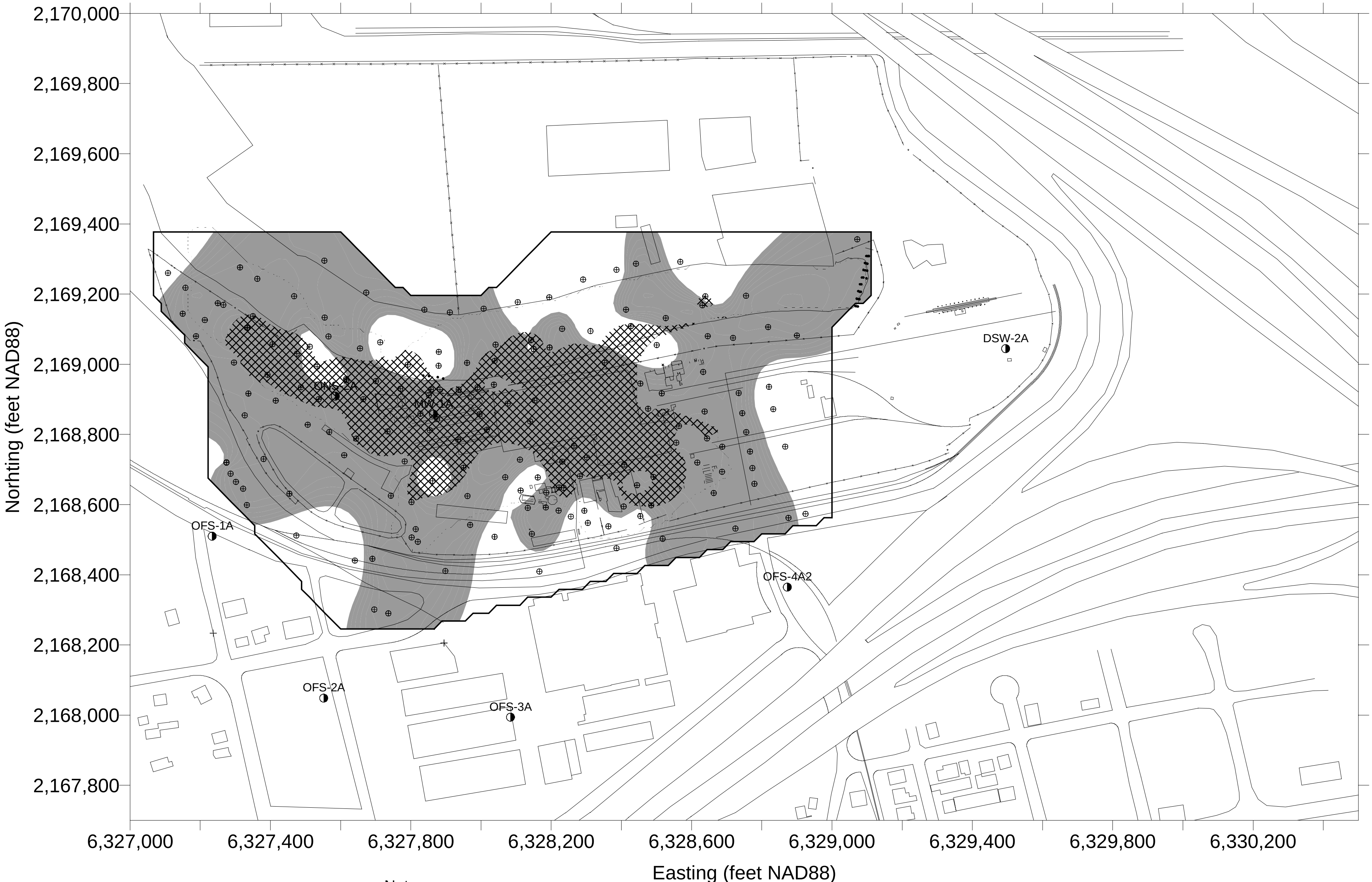
FY00 NAPL Investigation

Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-30 to -35 Feet Elevation

STOCKTON	**Figure 5-7**	CALIFORNIA



LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

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3. Cross-hatched regions are horizontal slices through a volume of space bounded by the top of NAPL and base of NAPL surfaces. NAPL is known to exist somewhere, but not necessarily everywhere, within the cross-hatched region, because NAPL is known to be present above and below this region.
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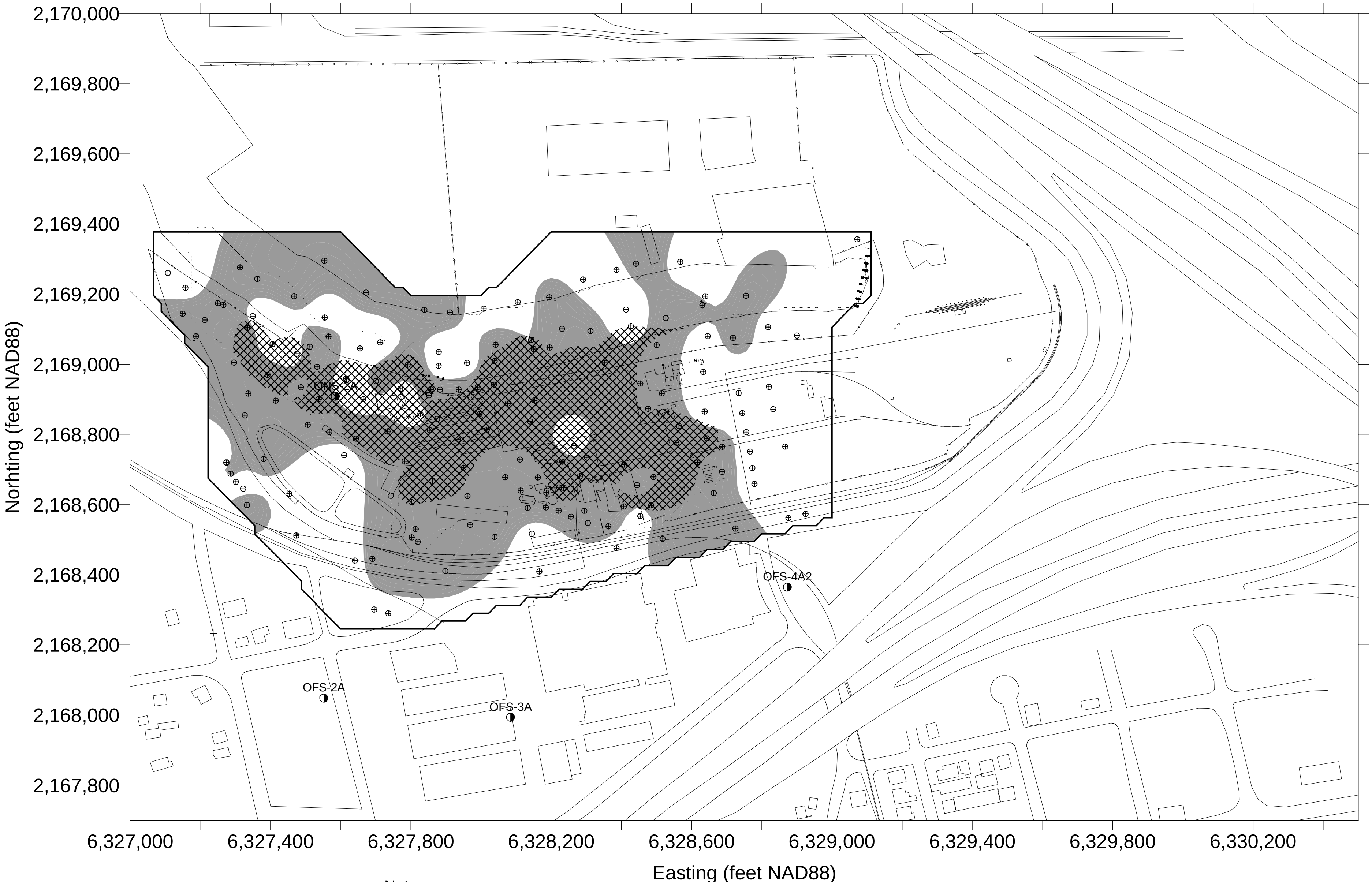
FY00 NAPL Investigation

Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-35 to -40 Feet Elevation

STOCKTON | **Figure 5-8** | CALIFORNIA



LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:
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FY00 NAPL Investigation

Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-40 to -45 Feet Elevation

STOCKTON	**Figure 5-9**	CALIFORNIA

Notes:

1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
2. Contouring accomplished using the minimum curvature method in Surfer v. 7.
3. Cross-hatched regions are horizontal slices through a volume of space bounded by the top of NAPL and base of NAPL surfaces. NAPL is known to exist somewhere, but not necessarily everywhere, within the cross-hatched region, because NAPL is known to be present above and below this region.
4. Data from 0 to -100 feet are limited to quantitative SCAPS results. Due to limited data below -100 feet, all available boring logs, SCAPS data, and geophysical logs were used. The limits of the bounding area reflect variations in quantity and quality of data.

LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

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McCormick and Baxter
Superfund Site
FY00 NAPL Investigation

Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-45 to -50 Feet Elevation

STOCKTON	**Figure 5-10**	CALIFORNIA

LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
2. Contouring accomplished using the minimum curvature method in Surfer v. 7.
3. Cross-hatched regions are horizontal slices through a volume of space bounded by the top of NAPL and base of NAPL surfaces. NAPL is known to exist somewhere, but not necessarily everywhere, within the cross-hatched region, because NAPL is known to be present above and below this region.
4. Data from 0 to -100 feet are limited to quantitative SCAPS results. Due to limited data below -100 feet, all available boring logs, SCAPS data, and geophysical logs were used. The limits of the bounding area reflect variations in quantity and quality of data.

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Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-50 to -55 Feet Elevation

STOCKTON	Figure 5-11	CALIFORNIA

LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
2. Contouring accomplished using the minimum curvature method in Surfer v. 7.
3. Cross-hatched regions are horizontal slices through a volume of space bounded by the top of NAPL and base of NAPL surfaces. NAPL is known to exist somewhere, but not necessarily everywhere, within the cross-hatched region, because NAPL is known to be present above and below this region.
4. Data from 0 to -100 feet are limited to quantitative SCAPS results. Due to limited data below -100 feet, all available boring logs, SCAPS data, and geophysical logs were used. The limits of the bounding area reflect variations in quantity and quality of data.

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Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-55 to -60 Feet Elevation

STOCKTON	**Figure 5-12**	CALIFORNIA

LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
2. Contouring accomplished using the minimum curvature method in Surfer v. 7.
3. Cross-hatched regions are horizontal slices through a volume of space bounded by the top of NAPL and base of NAPL surfaces. NAPL is known to exist somewhere, but not necessarily everywhere, within the cross-hatched region, because NAPL is known to be present above and below this region.
4. Data from 0 to -100 feet are limited to quantitative SCAPS results. Due to limited data below -100 feet, all available boring logs, SCAPS data, and geophysical logs were used. The limits of the bounding area reflect variations in quantity and quality of data.

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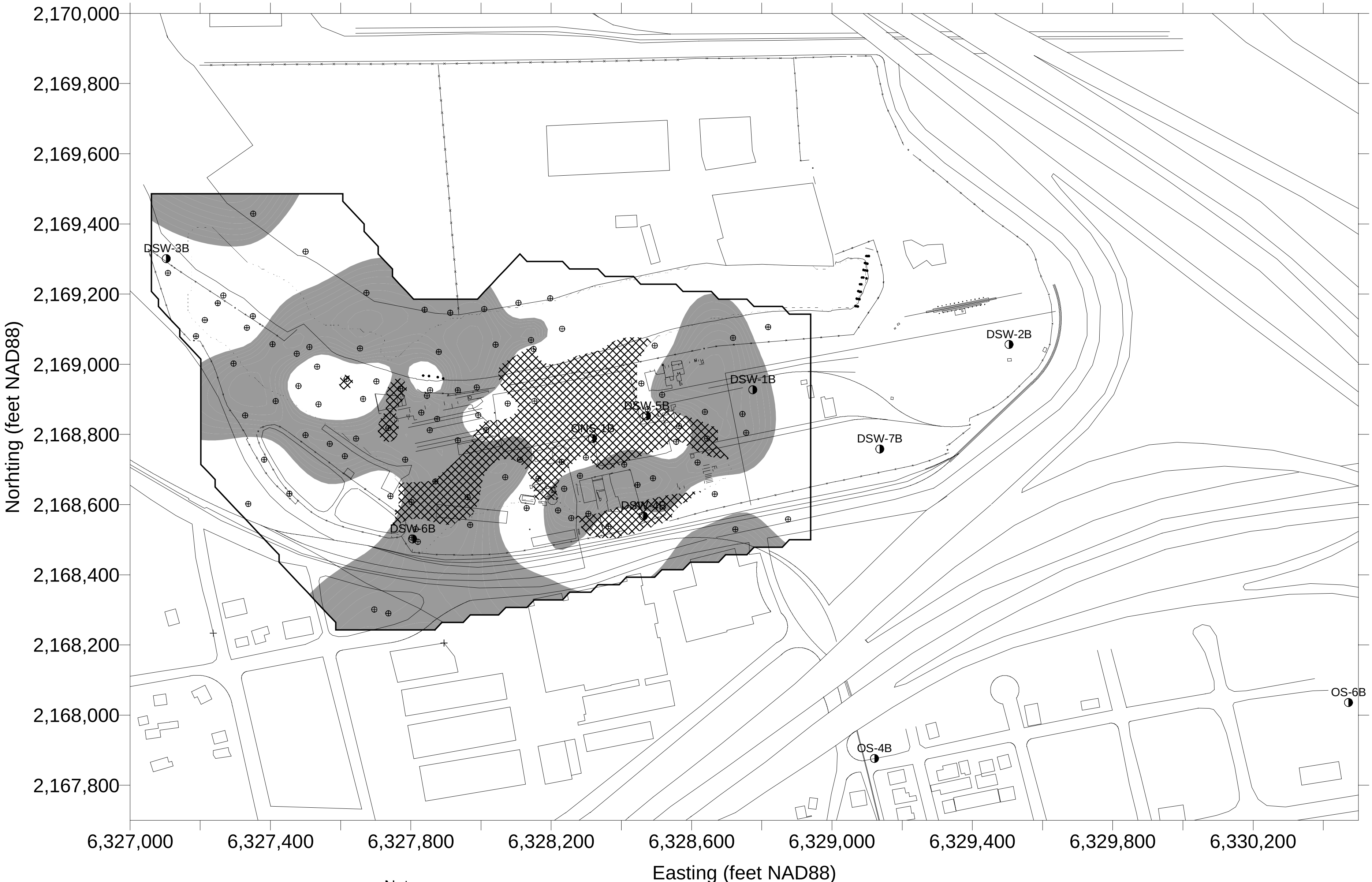
Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-60 to -65 Feet Elevation

STOCKTON	**Figure 5-13**	CALIFORNIA



LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
2. Contouring accomplished using the minimum curvature method in Surfer v. 7.
3. Cross-hatched regions are horizontal slices through a volume of space bounded by the top of NAPL and base of NAPL surfaces. NAPL is known to exist somewhere, but not necessarily everywhere, within the cross-hatched region, because NAPL is known to be present above and below this region.
4. Data from 0 to -100 feet are limited to quantitative SCAPS results. Due to limited data below -100 feet, all available boring logs, SCAPS data, and geophysical logs were used. The limits of the bounding area reflect variations in quantity and quality of data.

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Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-65 to -70 Feet Elevation

STOCKTON	**Figure 5-14**	CALIFORNIA

LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
2. Contouring accomplished using the minimum curvature method in Surfer v. 7.
3. Cross-hatched regions are horizontal slices through a volume of space bounded by the top of NAPL and base of NAPL surfaces. NAPL is known to exist somewhere, but not necessarily everywhere, within the cross-hatched region, because NAPL is known to be present above and below this region.
4. Data from 0 to -100 feet are limited to quantitative SCAPS results. Due to limited data below -100 feet, all available boring logs, SCAPS data, and geophysical logs were used. The limits of the bounding area reflect variations in quantity and quality of data.

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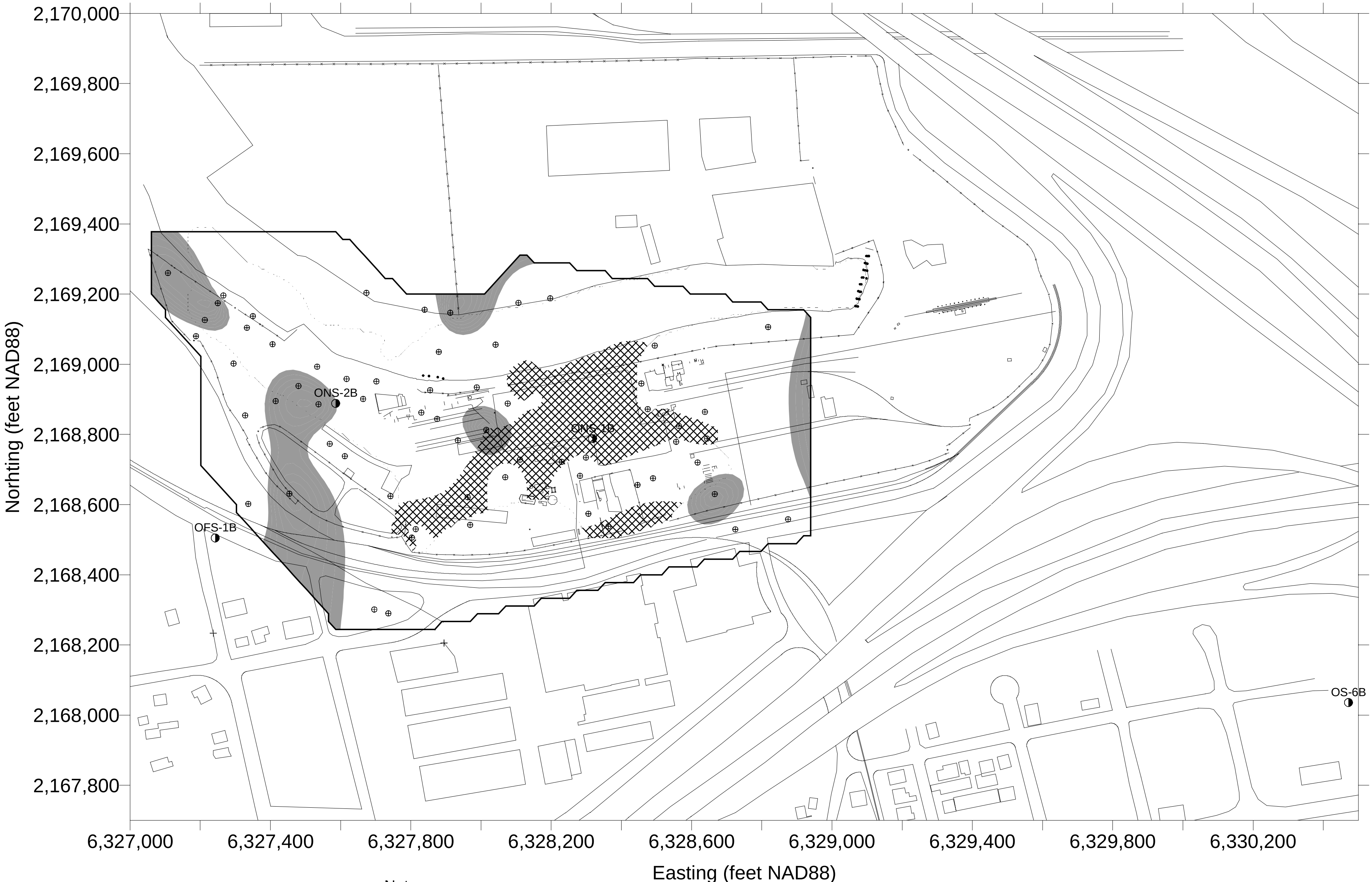
Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-70 to -75 Feet Elevation

STOCKTON	**Figure 5-15**	CALIFORNIA



LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
2. Contouring accomplished using the minimum curvature method in Surfer v. 7.
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Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-75 to -80 Feet Elevation

STOCKTON	**Figure 5-16**	CALIFORNIA

LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:
1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
2. Contouring accomplished using the minimum curvature method in Surfer v. 7.
3. Cross-hatched regions are horizontal slices through a volume of space bounded by the top of NAPL and base of NAPL surfaces. NAPL is known to exist somewhere, but not necessarily everywhere, within the cross-hatched region, because NAPL is known to be present above and below this region.
4. Data from 0 to -100 feet are limited to quantitative SCAPS results. Due to limited data below -100 feet, all available boring logs, SCAPS data, and geophysical logs were used. The limits of the bounding area reflect variations in quantity and quality of data.

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Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-80 to -85 Feet Elevation

STOCKTON	**Figure 5-17**	CALIFORNIA

LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
2. Contouring accomplished using the minimum curvature method in Surfer v. 7.
3. Cross-hatched regions are horizontal slices through a volume of space bounded by the top of NAPL and base of NAPL surfaces. NAPL is known to exist somewhere, but not necessarily everywhere, within the cross-hatched region, because NAPL is known to be present above and below this region.
4. Data from 0 to -100 feet are limited to quantitative SCAPS results. Due to limited data below -100 feet, all available boring logs, SCAPS data, and geophysical logs were used. The limits of the bounding area reflect variations in quantity and quality of data.

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Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-85 to -90 Feet Elevation

STOCKTON	**Figure 5-18**	CALIFORNIA

LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:
1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
2. Contouring accomplished using the minimum curvature method in Surfer v. 7.
3. Cross-hatched regions are horizontal slices through a volume of space bounded by the top of NAPL and base of NAPL surfaces. NAPL is known to exist somewhere, but not necessarily everywhere, within the cross-hatched region, because NAPL is known to be present above and below this region.
4. Data from 0 to -100 feet are limited to quantitative SCAPS results. Due to limited data below -100 feet, all available boring logs, SCAPS data, and geophysical logs were used. The limits of the bounding area reflect variations in quantity and quality of data.

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Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-90 to -95 Feet Elevation

STOCKTON	**Figure 5-19**	CALIFORNIA

LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
2. Contouring accomplished using the minimum curvature method in Surfer v. 7.
3. Cross-hatched regions are horizontal slices through a volume of space bounded by the top of NAPL and base of NAPL surfaces. NAPL is known to exist somewhere, but not necessarily everywhere, within the cross-hatched region, because NAPL is known to be present above and below this region.
4. Data from 0 to -100 feet are limited to quantitative SCAPS results. Due to limited data below -100 feet, all available boring logs, SCAPS data, and geophysical logs were used. The limits of the bounding area reflect variations in quantity and quality of data.

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Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-95 to -100 Feet Elevation

STOCKTON	**Figure 5-20**	CALIFORNIA

LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
2. Contouring accomplished using the minimum curvature method in Surfer v. 7.
3. Cross-hatched regions are horizontal slices through a volume of space bounded by the top of NAPL and base of NAPL surfaces. NAPL is known to exist somewhere, but not necessarily everywhere, within the cross-hatched region, because NAPL is known to be present above and below this region.
4. Data from 0 to -100 feet are limited to quantitative SCAPS results. Due to limited data below -100 feet, all available boring logs, SCAPS data, and geophysical logs were used. The limits of the bounding area reflect variations in quantity and quality of data.

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Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-100 to -105 Feet Elevation

STOCKTON	**Figure 5-21**	CALIFORNIA

Notes:
1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
2. Contouring accomplished using the minimum curvature method in Surfer v. 7.
3. Cross-hatched regions are horizontal slices through a volume of space bounded by the top of NAPL and base of NAPL surfaces. NAPL is known to exist somewhere, but not necessarily everywhere, within the cross-hatched region, because NAPL is known to be present above and below this region.
4. Data from 0 to -100 feet are limited to quantitative SCAPS results. Due to limited data below -100 feet, all available boring logs, SCAPS data, and geophysical logs were used. The limits of the bounding area reflect variations in quantity and quality of data.

LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

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Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-105 to -110 Feet Elevation

STOCKTON	**Figure 5-22**	CALIFORNIA

Notes:

1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
2. Contouring accomplished using the minimum curvature method in Surfer v. 7.
3. Cross-hatched regions are horizontal slices through a volume of space bounded by the top of NAPL and base of NAPL surfaces. NAPL is known to exist somewhere, but not necessarily everywhere, within the cross-hatched region, because NAPL is known to be present above and below this region.
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LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

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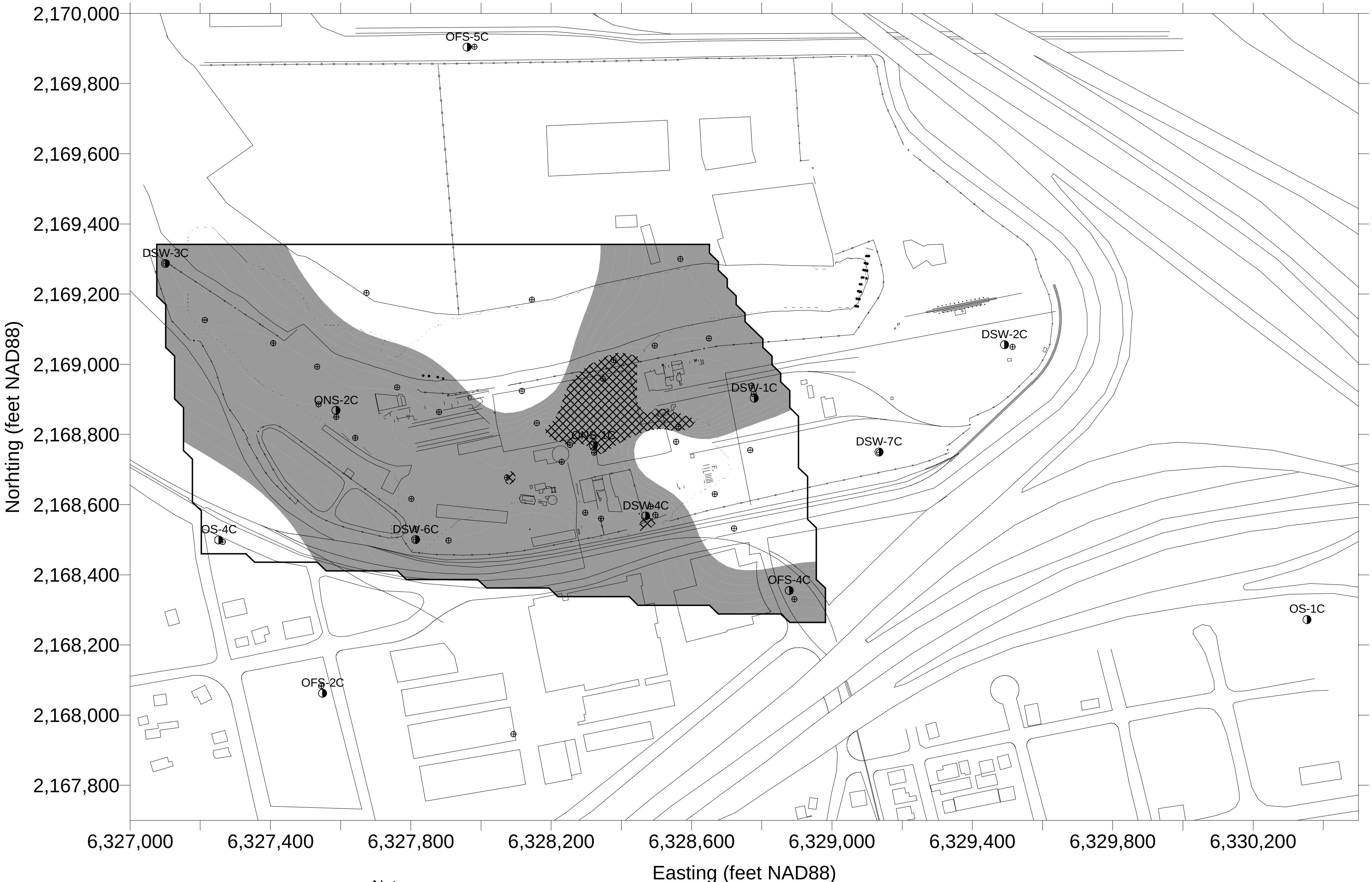
Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-110 to -115 Feet Elevation

STOCKTON	**Figure 5-23**	CALIFORNIA



LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
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Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-115 to -120 Feet Elevation

STOCKTON	**Figure 5-24**	CALIFORNIA

LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
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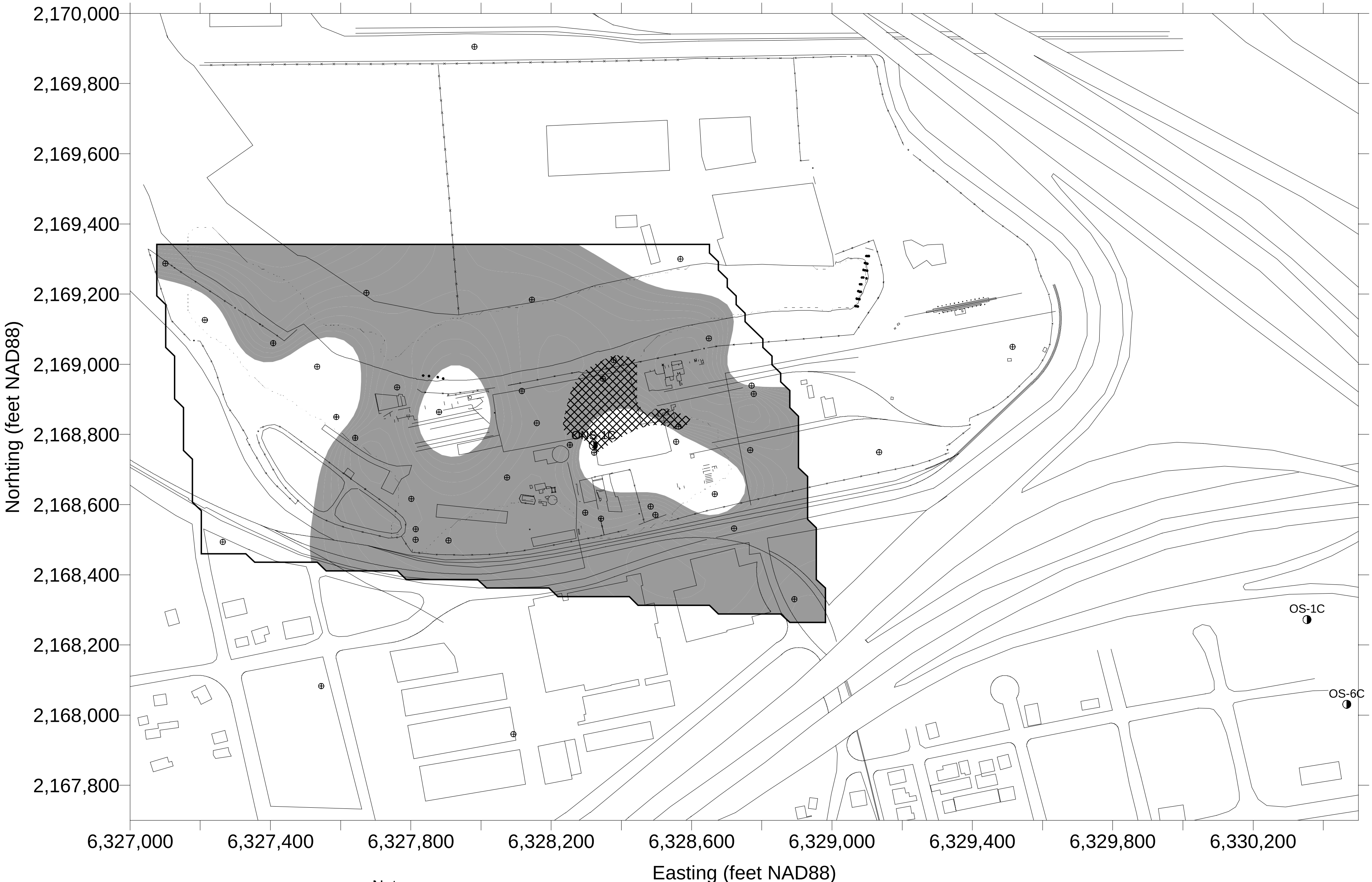
Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-120 to -125 Feet Elevation

STOCKTON	Figure 5-25	CALIFORNIA



LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:
1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
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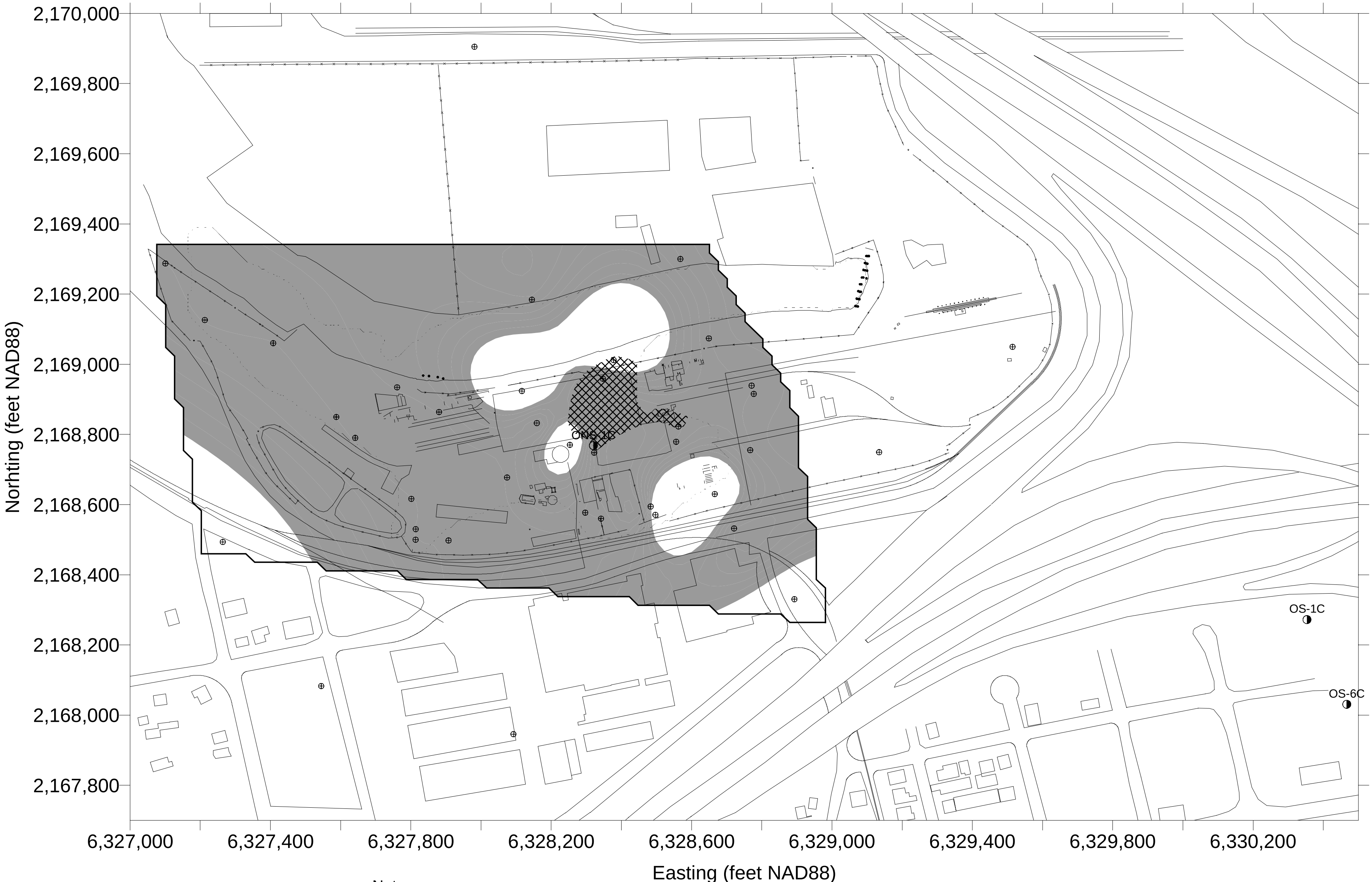
Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-125 to -130 Feet Elevation

STOCKTON | **Figure 5-26** | CALIFORNIA



LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
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3. Cross-hatched regions are horizontal slices through a volume of space bounded by the top of NAPL and base of NAPL surfaces. NAPL is known to exist somewhere, but not necessarily everywhere, within the cross-hatched region, because NAPL is known to be present above and below this region.
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Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-130 to -135 Feet Elevation

STOCKTON	**Figure 5-27**	CALIFORNIA

LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
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3. Cross-hatched regions are horizontal slices through a volume of space bounded by the top of NAPL and base of NAPL surfaces. NAPL is known to exist somewhere, but not necessarily everywhere, within the cross-hatched region, because NAPL is known to be present above and below this region.
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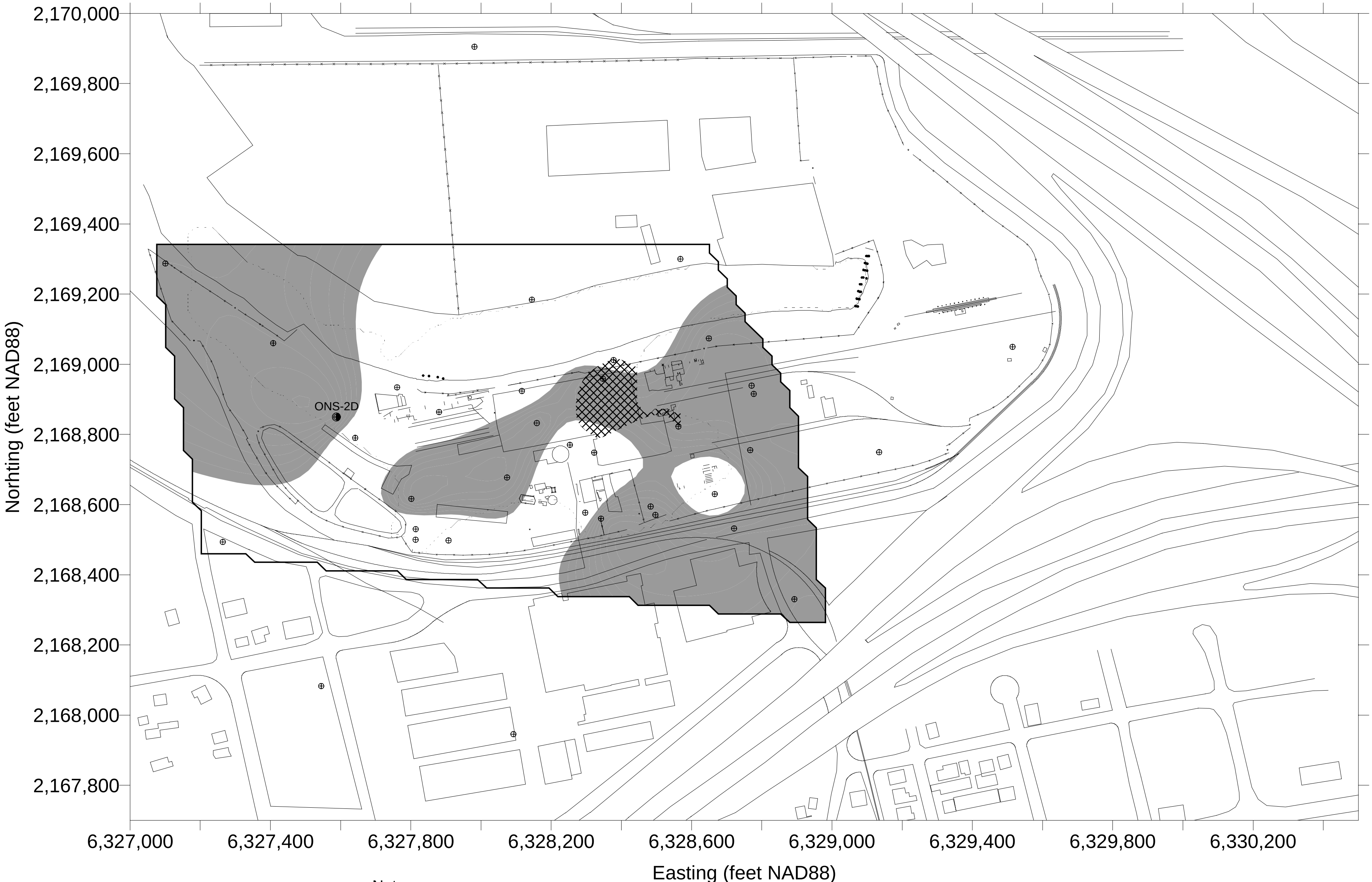
Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-135 To -140 Feet Elevation

STOCKTON	**Figure 5-28**	CALIFORNIA



LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
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3. Cross-hatched regions are horizontal slices through a volume of space bounded by the top of NAPL and base of NAPL surfaces. NAPL is known to exist somewhere, but not necessarily everywhere, within the cross-hatched region, because NAPL is known to be present above and below this region.
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Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-140 to -145 Feet Elevation

STOCKTON	**Figure 5-29**	CALIFORNIA

LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
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3. Cross-hatched regions are horizontal slices through a volume of space bounded by the top of NAPL and base of NAPL surfaces. NAPL is known to exist somewhere, but not necessarily everywhere, within the cross-hatched region, because NAPL is known to be present above and below this region.
4. Data from 0 to -100 feet are limited to quantitative SCAPS results. Due to limited data below -100 feet, all available boring logs, SCAPS data, and geophysical logs were used. The limits of the bounding area reflect variations in quantity and quality of data.

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Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-145 to -150 Feet Elevation

STOCKTON	**Figure 5-30**	CALIFORNIA

LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
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3. Cross-hatched regions are horizontal slices through a volume of space bounded by the top of NAPL and base of NAPL surfaces. NAPL is known to exist somewhere, but not necessarily everywhere, within the cross-hatched region, because NAPL is known to be present above and below this region.
4. Data from 0 to -100 feet are limited to quantitative SCAPS results. Due to limited data below -100 feet, all available boring logs, SCAPS data, and geophysical logs were used. The limits of the bounding area reflect variations in quantity and quality of data.

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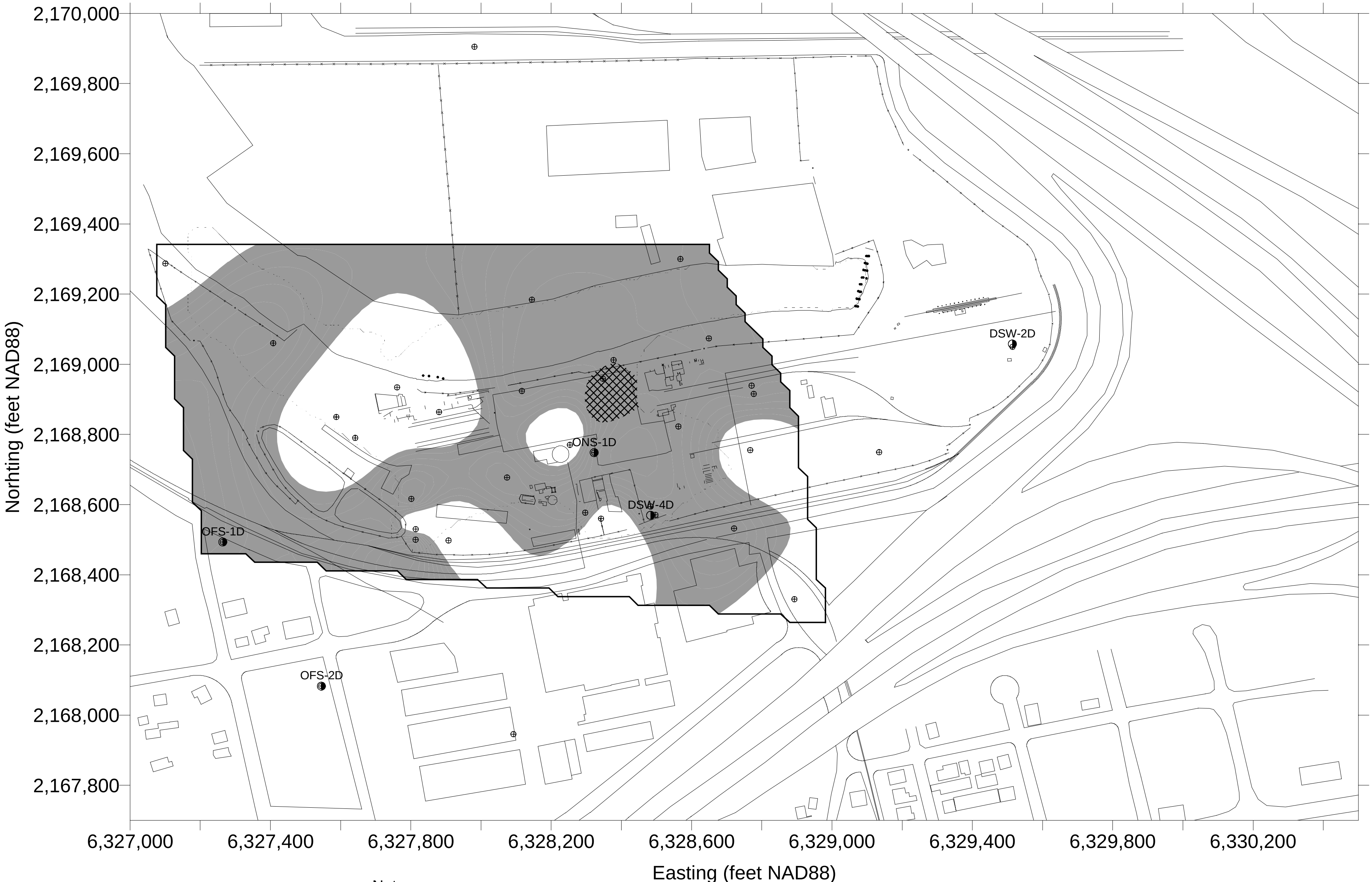
Superfund Site
FY00 NAPL Investigation

Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-150 to -155 Feet Elevation

STOCKTON	**Figure 5-31**	CALIFORNIA



LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
2. Contouring accomplished using the minimum curvature method in Surfer v. 7.
3. Cross-hatched regions are horizontal slices through a volume of space bounded by the top of NAPL and base of NAPL surfaces. NAPL is known to exist somewhere, but not necessarily everywhere, within the cross-hatched region, because NAPL is known to be present above and below this region.
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Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-155 to -160 Feet Elevation

STOCKTON	**Figure 5-32**	CALIFORNIA

LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
2. Contouring accomplished using the minimum curvature method in Surfer v. 7.
3. Cross-hatched regions are horizontal slices through a volume of space bounded by the top of NAPL and base of NAPL surfaces. NAPL is known to exist somewhere, but not necessarily everywhere, within the cross-hatched region, because NAPL is known to be present above and below this region.
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Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-160 to -165 Feet Elevation

STOCKTON	**Figure 5-33**	CALIFORNIA

LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
2. Contouring accomplished using the minimum curvature method in Surfer v. 7.
3. Cross-hatched regions are horizontal slices through a volume of space bounded by the top of NAPL and base of NAPL surfaces. NAPL is known to exist somewhere, but not necessarily everywhere, within the cross-hatched region, because NAPL is known to be present above and below this region.
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Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-165 to -170 Feet Elevation

STOCKTON	**Figure 5-34**	CALIFORNIA

LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
2. Contouring accomplished using the minimum curvature method in Surfer v. 7.
3. Cross-hatched regions are horizontal slices through a volume of space bounded by the top of NAPL and base of NAPL surfaces. NAPL is known to exist somewhere, but not necessarily everywhere, within the cross-hatched region, because NAPL is known to be present above and below this region.
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Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-170 to -175 Feet Elevation

STOCKTON	**Figure 5-35**	CALIFORNIA

LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
2. Contouring accomplished using the minimum curvature method in Surfer v. 7.
3. Cross-hatched regions are horizontal slices through a volume of space bounded by the top of NAPL and base of NAPL surfaces. NAPL is known to exist somewhere, but not necessarily everywhere, within the cross-hatched region, because NAPL is known to be present above and below this region.
4. Data from 0 to -100 feet are limited to quantitative SCAPS results. Due to limited data below -100 feet, all available boring logs, SCAPS data, and geophysical logs were used. The limits of the bounding area reflect variations in quantity and quality of data.

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Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-175 to -180 Feet Elevation

STOCKTON	**Figure 5-36**	CALIFORNIA

LEGEND

- Sand and gravel
- Clay and silt
- NAPL potentially present
- Monitoring well wholly or partially screened in this elevation interval
- Data points used in this analysis
- Limits of confidence in stratigraphic interpolation

Notes:

1. A simplifying assumption was made that, for each 5 foot horizontal slice, a total of one foot of sand represented a potentially significant pathway. Thus, areas on the map identified as sand and gravel have a minimum of one foot of sand or gravel in that 5 foot horizontal slice.
2. Contouring accomplished using the minimum curvature method in Surfer v. 7.
3. Cross-hatched regions are horizontal slices through a volume of space bounded by the top of NAPL and base of NAPL surfaces. NAPL is known to exist somewhere, but not necessarily everywhere, within the cross-hatched region, because NAPL is known to be present above and below this region.
4. Data from 0 to -100 feet are limited to quantitative SCAPS results. Due to limited data below -100 feet, all available boring logs, SCAPS data, and geophysical logs were used. The limits of the bounding area reflect variations in quantity and quality of data.

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Simplified Conceptual Geology
5 Foot Thick Horizontal Slice
-180 to -185 Feet Elevation

STOCKTON	**Figure 5-37**	CALIFORNIA